JANUARY, 1942

PUBLIC WORKS

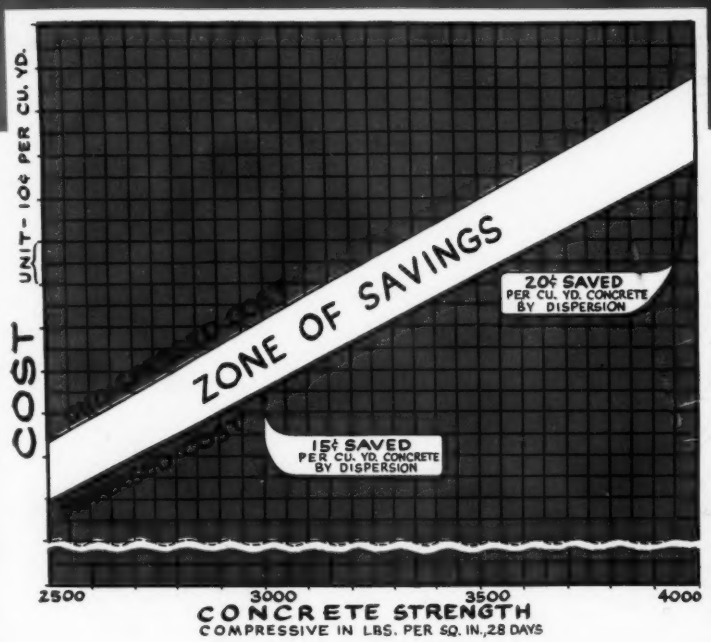
Streets and Highways • • • Water Works
Sewage Disposal • • • Airports

INCREASE CONCRETE DURABILITY AND CUT COSTS WITH

CEMENT DISPERSION

THROUGH THE USE OF

POZZOLITH



Based on cement at 50c per sack.

Whatever Your Concrete Requirements are—whether they be for low strength or high strength, for a 5-year shed or a 50-year Dam—**You Produce Them** at **Lower First Cost** with concrete designed and built with **Pozzolith.** In addition, subsequent costs for **Maintenance** are lower.

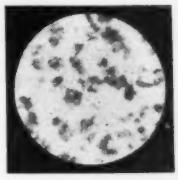
1. **Concrete of Given Strength is produced at Lower Cost.**
2. **Stronger and More Durable Concrete is produced at a Given Cost.**

HOW CEMENT DISPERSION WORKS

Investigation shows that with 28 days curing only 50% of the cement hydrates. [Anderegg and Hubbell, A.S.T.M. 29 II 554 (1929)].

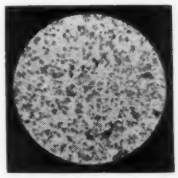
WITHOUT POZZOLITH

Cement particles in their normal state in water tend to gather in bunches; i.e., flocculate. Water never reaches some particles and many are only partly hydrated. This reduces the effectiveness of the cement, entraps water within the clumps, requires an excess of water for placement and often results in bleeding and segregation. See photomicrograph at right.



Cement suspended in water
UNDISPERSED

WITH POZZOLITH



Cement suspended in water
DISPERSED

With Pozzolith the dispersion principle operates to drive each particle apart, thus exposing all the cement particles to the vital hydrating action. See photomicrograph at left.

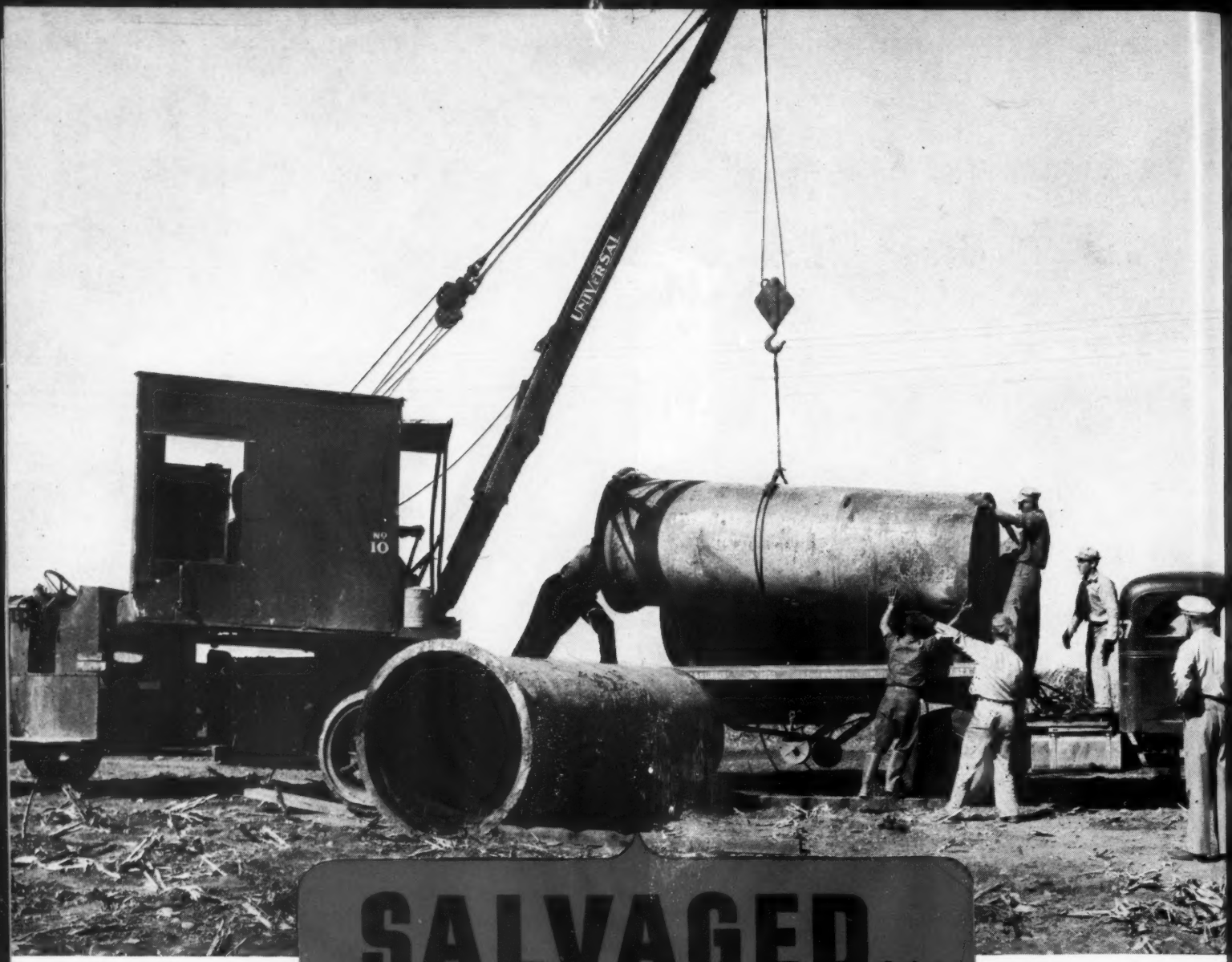
This dispersion makes the cement usable to its maximum efficiency since all the water is made available for lubrication of the mix and the entire surface area is exposed for hydration.

Send for Research Paper No. 36 "Economics of Cement Dispersion" and complete facts on Pozzolith.

THE MASTER BUILDERS COMPANY

CLEVELAND, OHIO **TORONTO, CANADA**

MASTER BUILDERS



SALVAGED... for an extra dividend

Loading salvaged 48-inch cast iron p
trucks at Columbus, Ohio. After
service, without any maintenance
pipe was taken up and sold by the
substantial price per ton, over and
removal expense.

● Thirty-seven years ago the city officials of Columbus, Ohio, authorized the construction of a cast iron sewer force main more than a mile long and 4 feet in diameter. Since that time, 160 billion gallons had been pumped through this cast iron line without one cent of maintenance cost on the pipe.

Recently the city completed a new sewage treatment plant and large intercepting sewer, making the old main unnecessary for further duty. Since it was cast iron pipe, it was possible to salvage 1150 tons of materi for either re-use or re-sale. The pipe was sold at a substanti price per ton, representing *an extra-dividend to the taxpaye* of Columbus.

It is impossible to foretell future requirements or pop lation shifts in metropolitan cities but any public official c be sure that, when water or sewer mains must be abandon or rerouted, the pipe can be salvaged or re-use *if it is cast iron pipe.*

Pipe bearing this mark is cast iron pipe.

TRADE MARK REG.

Available in diameters from 1¼ to 84 inches.

CAST IRON PIPE RESEARCH ASSOCIATION, THOMAS F. WOLFE, RESEARCH ENGINEER, 1013 PEOPLES GAS BUILDING, CHICAGO, ILLINO

CAST IRON PIPE

PUBLIC TAX SAVER NO. 1

When you need special information—consult the *classified* READER'S SERVICE DEPT., pages 55-57

The Editor's Page

MUNICIPAL PREPAREDNESS— Before the Bombs Fall

WITHIN two hours of the first "all clear" ever sounded on the Atlantic Coast of the United States, a long distance call came to PUBLIC WORKS from a city engineer asking for information about building air raid shelters. We have such information—a lot of it—but up to now the matter has seemed to be of only academic interest and we published little of it. But on December 7th this interest became intensely practical and we are preparing to publish at once a series of articles giving the latest results of English experience.

Meantime there is another feature of preparedness that is even more practical—that of maintaining throughout our cities the operation of the public services that are necessary to the life and health of the community. A bomb landing in a street excavates a crater from 5 to 25 ft. deep, shattering every water, sewer, gas or other pipe in the opening and probably causing leaks over a considerable radius in those not uncovered. These services must be restored in the shortest possible time. And city engineers, superintendents of water and of sewers, and other officials in charge of such services have as great an obligation to their citizens to prepare for maintaining their functioning in the most efficient manner possible as have army officers to protect the country in active warfare. Not to be prepared to do so to the best of their ability would be a disgrace.

What does such preparedness involve? Later we will endeavor to give suggestions in detail. But right now we urge each municipal official in charge of any public utilities to find at once the answer that fits his own conditions. Let him sit with pencil and paper before him for making notes and imagine that a bomb opens a crater at night in a certain street. As soon as he learns of it (memo—have police and all citizens instructed whom to notify in such cases), he should have the repair gang (is there an adequately equipped one?) on the job at once. The water main is broken—do the men know what street valves to close and have equipment for rapid closing? The sewer also is broken, a gas main and a conduit of power cables—therefore no street lights. Needed on the job at once—a portable light plant; portable pumps for dewatering the hole until the exit sewer can be opened to carry off the water. Meantime flow of gas from the mains must be stopped (that is easy—use rubber bags; but have we any and bicycle pumps for inflating them? and gas masks and gas detectors?) Before the water main is repaired and put in service it must be thoroughly sterilized. (At least one complete portable sterilizing equipment is needed.) The ends of the mains must be cut square (mechanical or flame cutters needed) and a length of pipe cut to fit between them and connected up by mechanical joints. Cracks or leaky joints in other pipe may develop when the water is turned on; have plenty of repair sleeves, clamps, etc. of all sizes on hand. Before this is done, the ends of the pipe may be plugged temporarily (if plugs of the right size are at hand) and the street valves opened and service renewed.

Now about the sewer. A temporary repair can be made by using a long length of corrugated or other light weight pipe spanning the crater. A cleaning machine should be available to remove the mud washed down the sewer.

Meantime, the roadway must be opened at least one lane wide (using a bulldozer?), and a beginning made at removing the debris (an elevating grader would help). The backfilling should be tamped thoroughly (pneumatic tamper); and pavement replaced (concrete mixer, reinforcement, and surfacing tools). The water has flooded nearby cellars and air-raid shelters and more portable pumps are needed, plenty of suction hose, etc.

That is a general outline for attending to one ordinary street crater—there may be several, and duplicate and replacement equipment should be kept on hand. There are many details to be filled in. Go over the entire procedure of repairs again and note everything needed—picks, shovels, sheeting and hammers, rubber boots—and list what must be obtained. Repeat the analysis for other conditions such as the walls of the pumping station blown in or the outfall sewer or the garbage incinerator destroyed.

In this war the health, efficiency and morale of the men in the shops is as important as that of those in the field, the air or on the sea. And it is up to our city officials to see that they are maintained at their best. We believe that the OPM, recognizing this, will grant priorities for the materials and equipment needed by the cities and by the manufacturers who can supply them, if a clear statement of the needs be presented.

This is a "blitzkrieg" war—surprise is its outstanding feature. Be prepared beforehand for instant use of material, men and method, planned to the last detail.

How to Apply for an Army Commission

Our friends in the Army tell us that it seems these days that literally everyone is trying to get into the Army. That is probably an exaggeration, but it is no doubt true that a great many readers of PUBLIC WORKS do desire to offer their services. Here is information on how to proceed.

(Continued on page 20)

PUBLIC WORKS Magazine . . JANUARY, 1942

VOL. 73. NO. 1

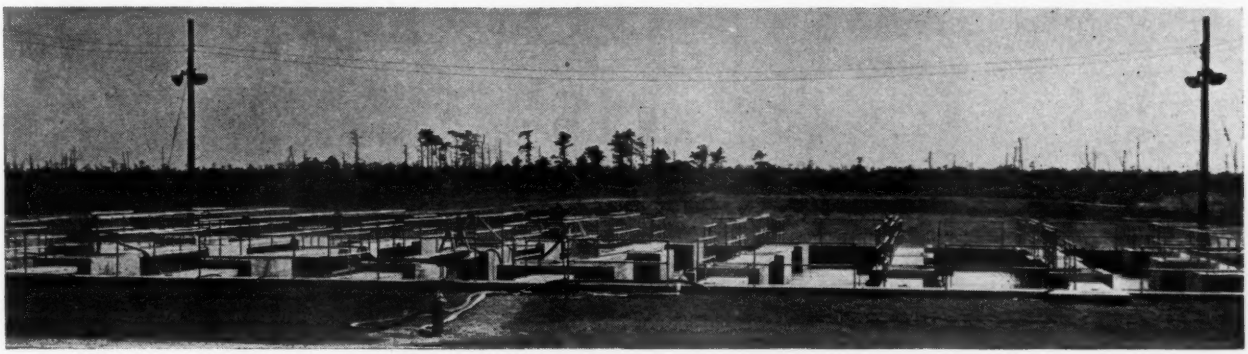


Fig. 3—The two Imhoff tanks at Camp Edwards.

Army Sewage Treatment Plants

1. Camp Edwards

The first of a series of articles which will describe the sewage treatment plants at our army camps.

THE sewage treatment plant at Camp Edwards, Mass., was designed by Samuel M. Ellsworth, consulting engineer, Boston, Mass. It comprises an Imhoff tank and a biofilter, with sand filters for final treatment. The design was based on a population of 30,000 men and an average rate of flow of 3,000,000 gpd., with a maximum rate of 6,000,000 gpd. There is no river or other body of water in the vicinity of the camp, so that all of the sewage must go into the ground.

Fig. 1 shows the comminutor and screen chamber, with the Parshall flume which is equipped with a Simplex meter. A screen chamber by-pass operates only when the comminutor is out of use or flows are excessive. The sewer feeding these works is 24-inch reinforced concrete.

Fig. 2. Grease Skimming Flocculation Tank. This tank is 32 ft. 6 ins. long, 19 ft. wide, and 10 ft. deep. Detention is provided for gross average sewage flow, including recirculated sewage, for 5½ minutes. To provide aeration, 96 12-in. sq. diffuser plates, with an air pressure of 4.5 to 5.0 lbs., furnish 0.03 cu. ft. of air per gallon of sewage. Baffles are arranged to provide a quiescent portion of the tank in which grease can rise. Air is supplied by a Roots-Connersville blower.

Fig. 3. Imhoff Tanks: There are two Imhoff tanks, each 90 ft. long and 50 ft. wide. The depth from the

Fig. 1—Comminutor and screen chamber.

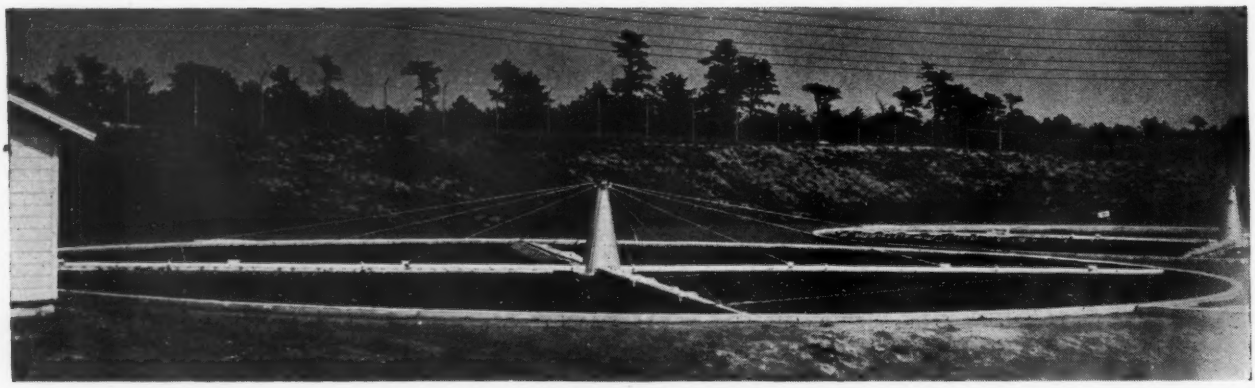


Fig. 4—The two trickling filters for biofilter operation.

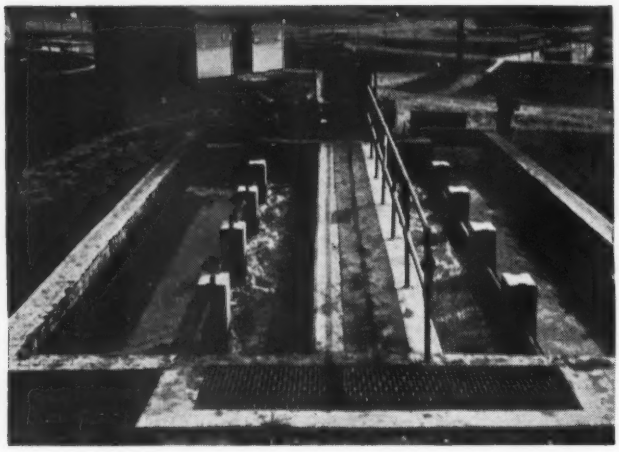


Fig. 2—Grease-skimming flocculation tank.

Fig. 6—Some of the 22 sludge-drying beds.

flow line or water surface to the bottom of the hoppers is 34 ft. The sedimentation compartments have a maximum depth of 14 ft. below the flow line and a capacity of 74,300 cu. ft., providing an average detention period (for gross flow, including recirculation) of 1.8 hrs., and an overflow rate of 960 gallons per sq. ft. per day. The ratio of gas vent area to surface area of tanks is 2.3%. Pre-cast concrete slabs form the sloping bottoms of the sedimentation chambers, being set 1 horizontal on 1½ vertical. Slots are 9 ins. wide. The flow of sewage through the tanks can be reversed. The sludge storage capacity is 138,300 cu. ft., or 4.6 cu. ft. per person on the design load of 30,000 men. Additional sludge storage tanks, with 1.0 cu. ft. per capita capacity, give a total sludge storage of 5.6 cu. ft. per capita. These were converted from the original settling tanks serving the old National Guard camp.

Fig. 4. Trickling Filters. Two biofilters are provided, each 100 ft. in diameter and 3 ft. deep, and provided with Dorr distributors. The design was based on a raw sewage B.O.D. of 0.175 lbs. per person per day, a removal by sedimentation of 30%, and by the filters of 55%, with the secondary clarifiers having an effluent containing 30 p.p.m. of B.O.D., which is applied to sand filters. Loading on the filters, on the design basis, is 2 lbs. per cubic yard of stone. The surface area of the filters is 0.36 acre and the rate of application of sewage, including recirculation, is 20.8 mgad., based on a population of 30,000 and a flow of 100 gpcpd. (The average flow for July, 1941, with a troop strength of 27,636 and 650 civilian employes, was 2.37 mgd.) Underdrains are Metropolitan "Monounit"; filter medium is granite, with the lower 6 ins. 2-in. to 3½-in., and 80% of the remainder 2-in. to 2½-in.

Secondary Settling Tanks. There are two final settling tanks, each 74 feet. in diameter, equipped with Link-Belt Circuline Collectors. Sidewater depth is 8 ft.; center depth 11 ft.; detention period 1.6 hrs.; overflow rate 870 gals. per sq. ft. per 24 hours.

Fig. 5. There are 12 acres of intermittent sand filters, with a design loading of 250,000 gallons per acre per day. Application is controlled manually. The beds have no underdrains because of the underlying sand and gravel formations. Dosage is normally to a depth of 4 to 6 ins., and there are about 2 applications per day.

Fig. 6. Sludge Drying Beds. There are 22 sludge drying beds, with a total area of 92,000 sq. ft., providing 3 sq. ft. per person. Beds are 80 ft. long;

(Continued on page 18)

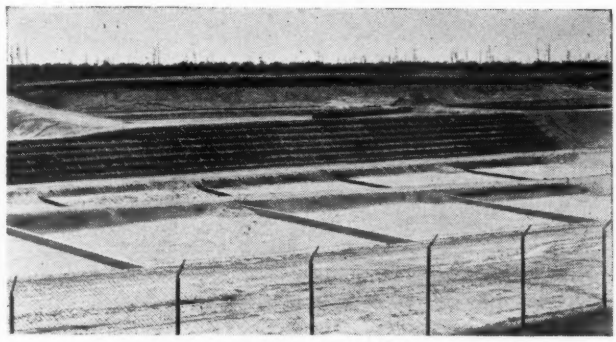
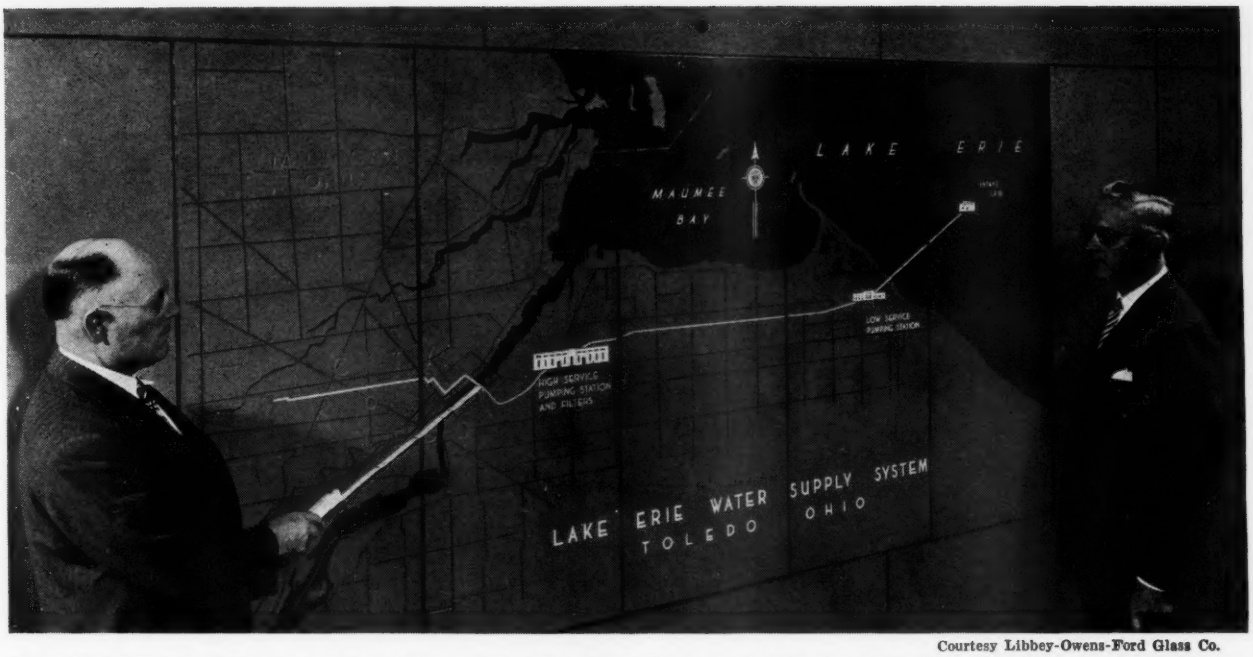


Fig. 5—Part of the intermittent sand filters.



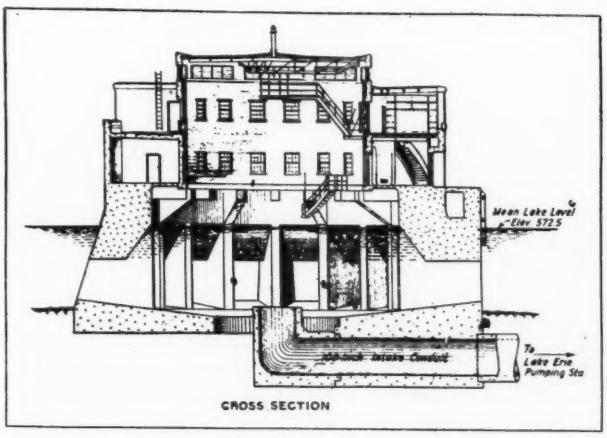
Courtesy Libbey-Owens-Ford Glass Co.

Map of Toledo's Lake Erie water supply system, sand-blasted and painted on a wall of the chemical building. City Manager Geo. N. Schoonmaker at left, Water Commissioner Robt. W. Furman at right.

Toledo Dedicates a Fine New Water Works

The new supply from Lake Erie, with a present capacity of 80 m.g.d., comprises intake crib, low and high service pumping stations, three miles of intake conduit and sixteen miles of pumping and trunk distribution mains; the whole costing nearly ten million dollars.

IN October, 1941, Toledo, Ohio, dedicated a new water supply system on which construction was started early in 1939. The city's supply had formerly been taken from the Maumee river, but Lake Erie was chosen for the new supply, chiefly because the lake water has, on an average, only about one-half the hardness of the river water and is of more uniform quality and consequently easier to treat; while the river water is being increasingly subjected to pollution by cities and industries, and the river in the vicinity of the intake was sometimes so lowered by wind acting on Lake Erie as to jeopardize the water supply.



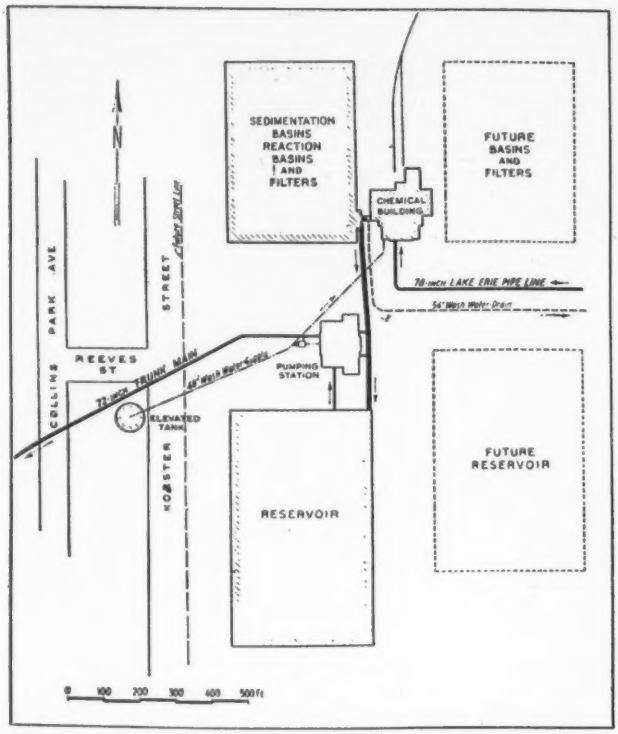
Cross-section of Toledo's intake crib.

The construction of a new lake supply was approved by popular vote in 1938 and Greeley & Hansen were employed to prepare plans and specifications, and for advisory supervision of construction under the direction of George N. Schoonmaker, the city's chief waterworks engineer (now also city manager).

With a present population of 410,000, it was estimated that Toledo would have a population of 680,000 in 1970 and 940,000 in 2000; and that the average and maximum consumption would be 82 mgd and 131 mgd, respectively, in 1970, and 113 mgd and 181 mgd in 2,000. Those portions of the project that cannot readily be duplicated or expanded were designed for the estimated consumption of 2,000; the others, for that of 1970.

The project comprises eight major elements:

1. An intake crib, and a conduit to
2. The low-service pumping station, which delivers water through
3. The Lake Erie pipe line to
4. The filter plant; adjacent to which is
5. A covered filtered water reservoir,
6. A high-lift or main pumping station, and
7. An elevated tank. From these
8. A trunk main extends in a general westerly direction across the city.



Plan of present and future construction for treatment plant and main pumping station.

Description of the Intake Crib

This was constructed about two miles off shore in 22 ft. depth of water below mean lake level. Little pollution reaches here from the Maumee river. The hardness is normally 125 ppm with an occasional maximum of 178 ppm.

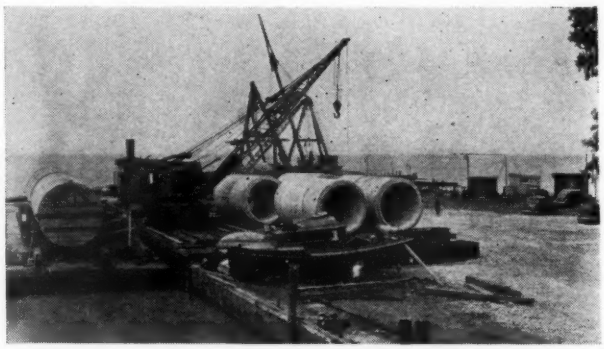
The crib is circular, 100 ft. diameter at the bottom (5 ft. below normal lake bottom) and 83 ft. at a point 3 ft. 6 in. above mean lake level. It contains 16 ports 10 ft. square, without sluice gates, which admit water into a central well 60 ft. in diameter, near the bottom of which is a 12 ft. diameter inlet to the intake conduit. It is constructed of reinforced concrete 20 ft. thick at the bottom and 11½ ft. at the top; encased, from 7 ft. below to 10 ft. above mean lake level, in ⅜ in. steel armor for protection against abrasion by floating ice and debris. It is floored over at 10 ft. above lake level, and above this the superstructure is of reinforced concrete 18″ thick for a height of 14 ft., and of brick in a reinforced concrete frame above this. The roof is surmounted by a navigation warning light about 48 ft. above the water.

On the first floor are boilers for the steam heating plant, a refuse incinerator, coal storage room, gasoline engine generator unit and two store rooms. At this level is a small landing dock equipped with a 2-ton pillar crane with a 20 ft. boom with full circle swing. On the second floor are two sleeping rooms, dining room, kitchen, office, etc. All liquid wastes are collected in receptacles and dumped at a safe distance from the intake, and no laundering is permitted at the crib. Therefore storage space is provided for bedding, clothing, etc., sufficient for periods of isolation that may last two or three months in winter, during which season it is proposed to keep men at the intake to handle any ice troubles. For the same reason, ample storage is provided for fuel and food.

There is two-way radio service between intake crib and low service pumping station (authorized by the FCC), which is the only means of communication with the crib.

The Intake Conduit

The intake conduit is 108″ inside diameter and 15,500 ft. long, with the invert 37 ft. below normal lake level. For 9,500 ft. from the crib it is of reinforced concrete pipe laid in a subaqueous trench having a minimum depth of 17 ft. 5 in. below lake bottom; the remaining 6,000 ft. is in earth tunnel; this combination having been found to be the cheapest of several on which bids were received. The concrete pipe has 12″ walls; was made in 24 ft. lengths, and the joints are bell and spigot with a steel ring in the bell and another on the spigot, each grooved for a circular rubber gasket that was squeezed into place between them when the pipes were pulled together by means of two bolts through harness lugs, one at each end of the horizontal diameter of the pipe.

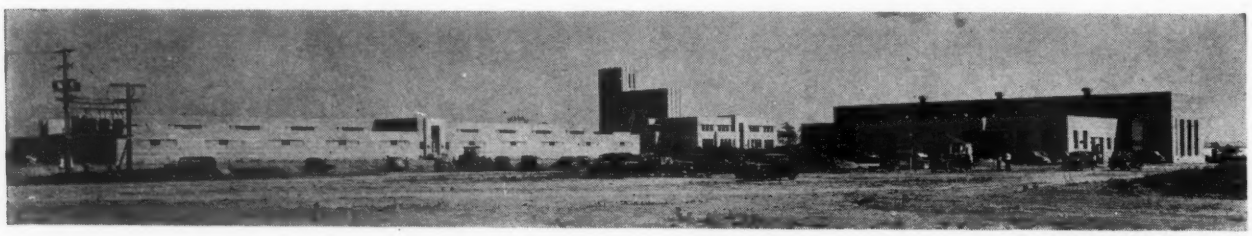


Loading 108″ Lock Joint Reinforced Concrete Subaqueous Pipe on barges for laying on bed of Lake Erie.

The tunnel was in firm clay, supported by steel liner plates lined with 18″ of reinforced concrete.

The Low Service Pumping Station

This was designed to permit a drawdown in the suction wells of 17 ft. below mean lake level. There are two pump cells, so that if failure of pump or piping should flood one cell the other can remain in service. At present there are two pumps in each cell —one 55 mgd capacity at 60 ft. head, the other three 50 mgd at 110 ft. head. They are horizontal centrifugals direct-connected to multi-speed slip-ring motors, with control equipment that permits reduction of



Courtesy Link-Belt Co.

General view of Toledo's water purification plant.

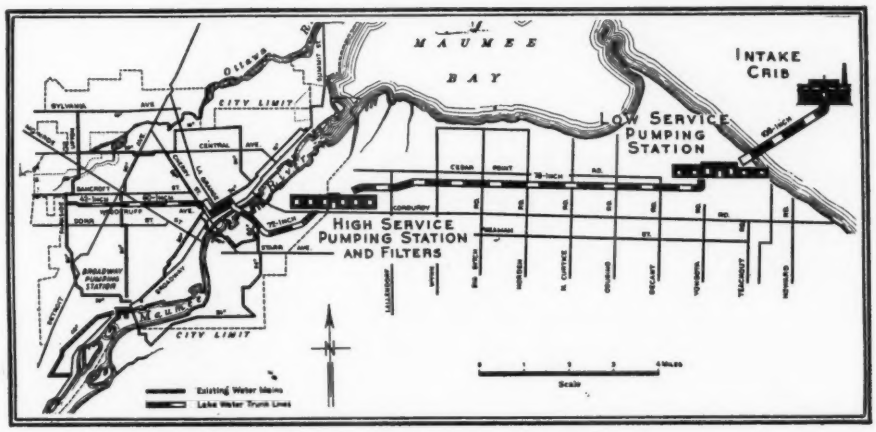
speed 30% in 11 steps; this because of the wide variation in pumping head due to the long lengths of intake and discharge conduits. Slip-ring motors with variable-speed pumps produce lower total annual costs than any other method of meeting this requirement, considering the rates for electric power obtainable.

Underground power cables were economically impracticable, and the station is served with two overhead power cables from two separate sources. There are, as a stand-by, two 628 kw generator units driven by diesel engines which will furnish sufficient power to pump 85 mgd. Space is available in the engine room for adding a third unit, and in the pump cells for substituting larger pumps. The discharge piping from each pump is carried into two headers so arranged that failure of either header will not require shutting down any pumping unit. All main valves are electrically operated, and lights at the operating stands and switchboard indicate the position of each valve.

Coarse racks are provided in the inlet channels, ahead of mechanically operated traveling screens.

These pumps deliver water to the filtration plant through 47,000 ft. of 78" steel pipe made in 40 ft. lengths joined with Dresser couplings. The pipe walls are 9/16 in. thick except beneath highway and railroad crossings, where they are 11/16 in. The pipes were lined and coated at the mill with coal tar enamel applied by spinning.

A 78x42 in. Venturi meter is provided in this line in a vault just outside the pumping station, with indicating and recording instruments in the pumping station. The pipe line is divided into three sections by two valves; adjacent to each of which are tees for cross connections to future parallel mains. Two 24" surge compressors are installed at the low-service pumping station to protect the pipe line in case of power failure or sudden stopping of the pumps.



General plan of the Lake Erie water supply system.

Structures at Collins Park Area

At Collins Park area are located the chemical building, filter building, high-service pumping station, filtered water reservoir and elevated storage tank. All the buildings are of brick and structural steel framing on reinforced concrete substructures, with roofs of precast concrete slab construction covered with insulating material and 4-ply felt, asphalt and gravel. The first floor of the chemical building contains administrative offices, a lecture room seating 150 persons, machine shop and garage. On the second floor are chemical, bacteriological and research laboratories, and a photographic dark room; also chemical feeders and chemical storage. Dry chemicals are received in bulk and unloaded with pneumatic equipment into steel storage bunkers, of which there are eight, each of 2100 cu. ft. capacity. A screw conveyor above the bunkers transports the chemicals to any point desired, and another below the bunkers conveys them to the dry-feed machines. Activated carbon is received and handled in bags. Liquid chlorine is received in ton containers and aqueous ammonia in tank cars.

Link-Belt paddle mixers.

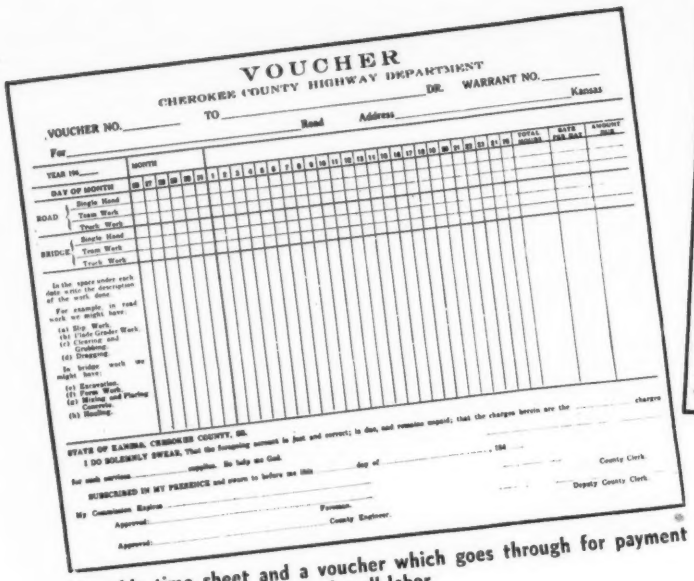
As the laboratory benches and sinks are in front of windows that face south, these are glazed with a special heat-absorbing plate glass which absorbs about 50% of the solar heat from the sunlight passing through them.

Filter Plant.—This, comprising four reaction and sedimentation basins and twenty filters, has a nominal capacity of 80 mgd but can be operated for short periods at 120 mgd. The basins and filters are arranged in two equal groups, separated by a cross gallery; and each of the two reaction and sedimentation basins in each group can be operated independently in connection with 5 of the filters.

The water and applied chemicals are mixed by paddle-wheel type stirring equipment in reaction basins that give a 45 min. retention period when operating at 80 mgd. Each of the four basins is divided into three compartments 78 ft. long and 17 ft. wide with 18 ft. water depth. From the last compartment the water flows through openings into an outlet channel, and from this into the sedimentation basins through openings equipped with movable louvres.

Each of the four sedimentation basins is 85 x 279 ft. and divided by low walls into five compartments, each provided with sludge collecting equipment. These basins, except for the extreme south ends, are entirely underground and covered with concrete roofs and two feet of earth fill, supported by the basin walls and 256 concrete columns. These basins give approximately 3 hours detention. From them the settled water travels to the filters through a concrete conduit 17 ft. wide by 7 ft. 7 in. high.

(Continued on page 39)



VOUCHER

CHEROKEE COUNTY HIGHWAY DEPARTMENT

DR. WARRANT NO. _____

VOUCHER NO. _____ TO _____ Road _____ Address _____ Kansas

For _____

YEAR 19__ MONTH

DAY OF MONTH 28 27 29 30 31 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 TOTAL HOURS RATE PER DAY AMOUNT DUE

ROAD { Single Hand / Team Work / Truck Work

BRIDGE { Single Hand / Team Work / Truck Work

In the space under each date write the description of the work done.

For example, in road work we might have:
(a) Rip Work.
(b) Blade Grader Work.
(c) Clearing and Grubbing.
(d) Dragging.

In bridge work we might have:
(e) Excavation.
(f) Form Work.
(g) Mixing and Placing Concrete.
(h) Hauling.

STATE OF KANSAS, CHEROKEE COUNTY, SS.

I DO SOLEMNLY SWEAR, That the foregoing account is just and correct; is due, and remains unpaid; that the charges herein are the _____ charges for such services _____ supplies. So help me God.

SUBSCRIBED IN MY PRESENCE and sworn to before me this _____ day of _____, 194__

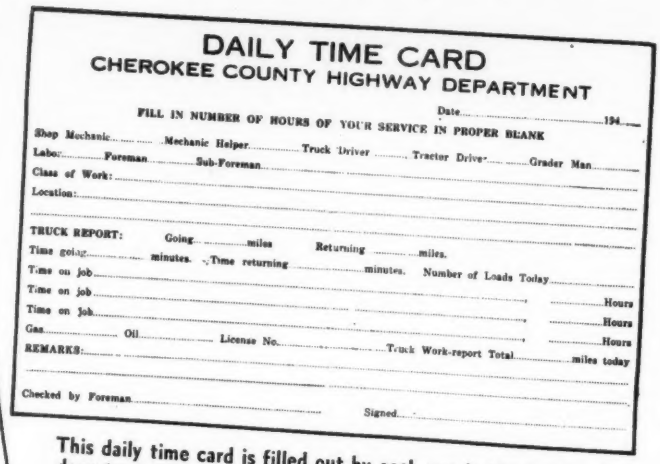
_____ County Clerk

My Commission Expires _____ _____ Deputy County Clerk

Approved: _____ Foreman.

Approved: _____ County Engineer.

Monthly time sheet and a voucher which goes through for payment for all labor.



DAILY TIME CARD

CHEROKEE COUNTY HIGHWAY DEPARTMENT

Date _____ 194__

FILL IN NUMBER OF HOURS OF YOUR SERVICE IN PROPER BLANK

Shop Mechanic _____ Mechanic Helper _____ Truck Driver _____ Tractor Driver _____ Grader Man _____

Labor _____ Foreman _____ Sub-Foreman _____

Class of Work: _____

Location: _____

TRUCK REPORT: Going _____ miles Returning _____ miles.

Time going _____ minutes. Time returning _____ minutes. Number of Loads Today _____

Time on job _____ Hours

Time on job _____ Hours

Time on job _____ Hours

Gas _____ Oil _____ License No. _____ Truck Work-report Total _____ miles today

REMARKS: _____

Checked by Foreman _____ Signed _____

This daily time card is filled out by each one in the engineering department except the county engineer and the secretary.

How One County Keeps Within

The personnel of the engineering department of a county that maintains 1050 miles of roads, and the system of records and reports for a force of 1200 men.

CHEROKEE COUNTY, Kansas, operates under the County Unit Plan, which was adopted in 1932 and went into effect in 1933, which provides that all except State roads be under the supervision of the Board of County Commissioners, which is required by law to select a county engineer, who has active supervision of all road work. There are 1,050 miles of county roads and 107 miles of State roads. Approximately 900 miles are surfaced with either chat, river gravel, crushed limestone, or shale. The remaining 150 miles are earth roads.

The relief work under K.E.R.C. and W.P.A. has been principally building reinforced concrete culverts and bridges and widening the grades on those roads which should be main connecting links. The surfacing on these projects is entirely of chat, river gravel, or crushed limestone.

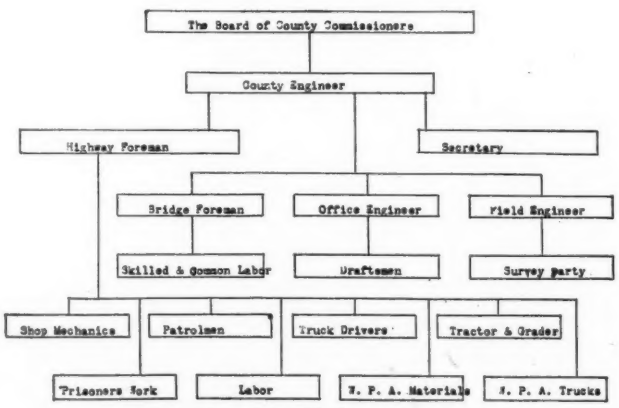
Columbus, the county seat, is located in the center of the county. The beginning of the Ozark uplift is in the southeastern part of the county; the central portion, being on a sandy outcrop, is gently rolling, while the western portion of the county is largely in the flood plane of the Neosho river and its tributaries. Many problems of maintenance are presented in this range of terrain—quick runoff and eroded surfaces on the rocky hills of the southeastern part, and overflow and flood water conditions in the western portion of the county.

The county is now divided into 13 patrol or maintenance districts, the mileage in which varies from 50 to 80 miles, this being determined partially by location and also by traffic and surface conditions of the roads to be maintained. Each district is in charge of one full-time man, who has a motor patrol grader, and small tools for single hand work.

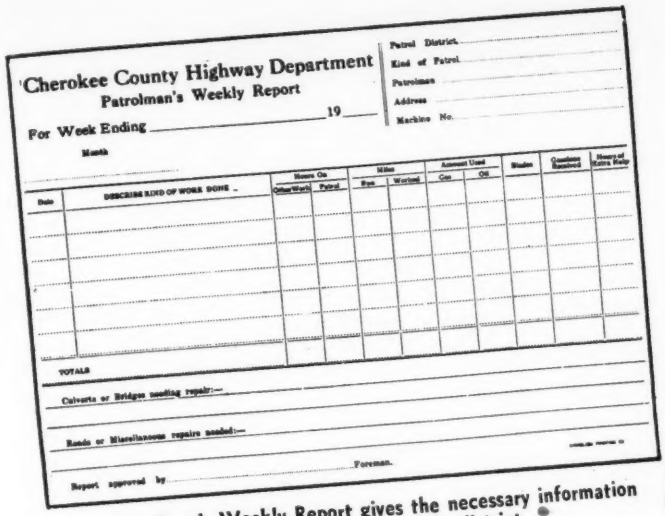
The personnel of the county engineering department is made up of the county engineer; one field engineer with two assistants, who do drafting or work on plans when in the office; one office engineer, who has charge of completion of plans and estimates; one secretary, who does the bookkeeping, typing, assisting with the files, and compilation of all reports. There are also a general foreman, a bridge foreman, a head mechanic and an assistant mechanic. The truck drivers, tractor drivers, gradermen, helpers, patrolmen, and laborers are under the supervision of the general foreman. The bridge foreman, working directly under the supervision of the county engineer, has a regular crew of six men, employing additional labor as needed.

Below is shown the plan of organization of the Highway Department of Cherokee County.

Our general object has been to get all mail routes, all farm-to-market roads, in fact every farm house, on



Organization of the Highway Department.



Cherokee County Highway Department
Patrolman's Weekly Report
For Week Ending _____ 19____
Month

Patrol District
Kind of Patrol
Patrolman
Address
Machine No.

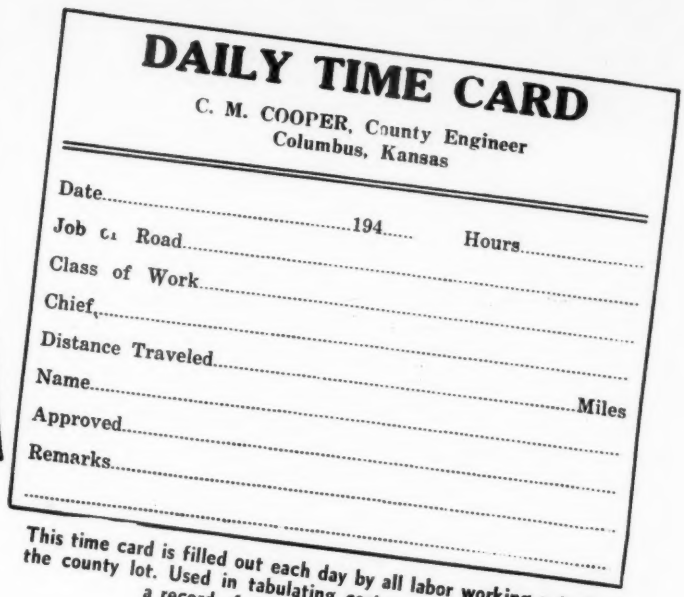
Date	DESCRIBE KIND OF WORK DONE	Hours On		Miles		Amount Used		Blades	Condition Received	Hours of Extra Help
		Other Work	Patrol	Run	Worked	Gas	Oil			
TOTALS										

Culverts or Bridges needing repair:—

Roads or Miscellaneous repairs needed:—

Report approved by _____ Foreman.

The Patrolman's Weekly Report gives the necessary information relative to his machine and his district.



DAILY TIME CARD
C. M. COOPER, County Engineer
Columbus, Kansas

Date _____ 194____ Hours _____
Job on Road _____
Class of Work _____
Chief _____
Distance Traveled _____
Name _____ Miles
Approved _____
Remarks _____

This time card is filled out each day by all labor working out of the county lot. Used in tabulating costs on all jobs and gives a record of what each man is doing.

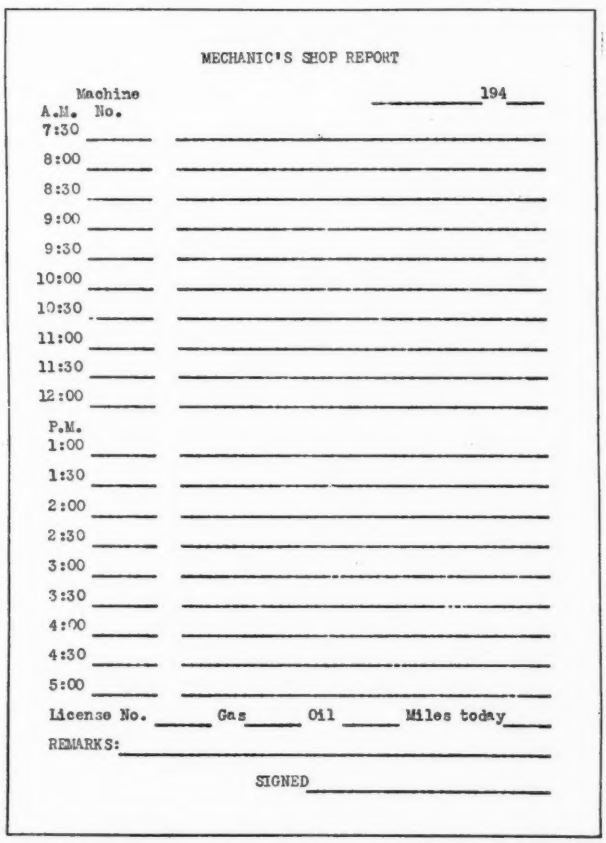
the Road Budget

By C. M. COOPER
County Engineer of Cherokee County, Kansas

a surfaced road so that mud would not interfere with traffic. This accomplishment is not so far off, since there are now only 100 miles more to be surfaced to attain it.

On taking over the office of County Engineer, July 1, 1935, the lack of records suitable to use as a guide to spending was so noticeable that we started a system of daily reports from all employees. The only records that had been kept were a listing of the salaries and payments on invoices or miscellaneous labor accounts, separated to show from what fund they were paid; whereas we needed to know the cost of upkeep on our machines, the consumption of gas and oil per hour or mile of use, the cost of maintaining certain roads, or the roads of a certain part of the county, and the cost of maintenance during different seasons or parts of the year. And further, we needed to know the total costs by the year for upkeep of equipment and maintenance of our roads so that we could have some idea of the amount needed to carry on throughout the year. With this knowledge, we could then more intelligently plan for new construction and make certain savings in cost of upkeep.

In setting up our system of records and reports, we did not have the advice of auditors or accountants. Our method was to explain the problem to each person interested and together to work out a form that seemed to answer our needs. The secretary was consulted as to her idea of filing and tabulating the reports. The full cooperation of every one down to the last laborer was necessary in order that the records be correct yet not become a burdensome task on anyone. Many refinements were developed later, many more could be developed if our county were not so handicapped for funds.



MECHANIC'S SHOP REPORT

Machine _____ 194____

A.M.	No.	
7:30	_____	_____
8:00	_____	_____
8:30	_____	_____
9:00	_____	_____
9:30	_____	_____
10:00	_____	_____
10:30	_____	_____
11:00	_____	_____
11:30	_____	_____
12:00	_____	_____
P.M.		
1:00	_____	_____
1:30	_____	_____
2:00	_____	_____
2:30	_____	_____
3:00	_____	_____
3:30	_____	_____
4:00	_____	_____
4:30	_____	_____
5:00	_____	_____

License No. _____ Gas _____ Oil _____ Miles today _____
REMARKS: _____
SIGNED _____

This report gives the cost of labor on the various repair jobs. The list of parts used is filed with this on a plain sheet of paper.

On accout of the heavy relief load, averaging 1,200 men working on W.P.A. road projects, for the past five years we have had no contract work, so records for that class of expenditures were not needed, and the W.P.A. have their own type of records and reports.

The results of the daily reports are set on columnar sheets so that we can tell what any piece of equipment is doing. These are set out for each week, so that it is a small matter to get a clear picture of the essential facts at any time without waiting until the end of the year, when the final totals are set up in a formal report or recapitulation.

Records showed where all materials, parts, and labor were used, and on what piece of equipment they were placed. Every gallon of gasoline, lubricating oil and greases was charged to the machine receiving it. These data soon showed that certain equipment being used to maintain our roads should be abandoned and new units placed in operation.

Since the records have been started and the men know what we are doing, they are interested in keeping down costs and ask for information from time to time as to how they are doing. We complete each report only at the end of the year, but can turn to our files on any unit to see how it is performing any time. Interim reports are prepared for the Board of County Commissioners each month so that they may know how the funds are holding out. The report or recapitulation at the end of the year is blue printed and distributed to all the employees in responsible positions, such as the truck drivers, tractor drivers, grader men, patrolmen, etc.

In repairing equipment, the county engineer buys those parts reported as needed by the head mechanic or general foreman. Supplies such as cement, small tools and local materials for construction are purchased by the Board of County Commissioners. Requisitions from the county engineer showing needed materials and stating what fund is to pay for same, are filed with the Board, which then issues a purchase order to some local firm to supply the required materials, etc. On construction materials such as reinforcement steel and lumber, bids are asked on specified quality and amounts. A purchase order is then issued by the Board to the low bidder on quality specified. In each instance the purchase order indicates what fund is to pay for the supplies, etc., ordered. This permits the county engineer to know at all times the condition of the various funds. A copy of the purchase order stays with the County Commissioner's file in the county clerk's office and a copy is filed in the office of the county engineer.

Since maintenance in our county is the unknown factor in staying within the budget or available funds, we needed all the facts possible. The Board of County Commissioners set up the levy from the budget prepared by the county clerk, who obtained his information from the various departments in the county. The road and bridge funds suffer because of the heavy relief load that must be carried by our county, due to the legal limitations of the total amount that can be levied for all purposes. Our estimated highway department needs, as shown on the budget, are always in excess of the amount possible to levy for such purposes. This being the case, we have to "cut the coat according to the cloth." Also new work or reconstruction cannot be planned until the amount needed for maintenance is determined. Kansas has a cash basis law which does not allow any expenditures in excess of money on hand. We cannot go in debt.

In addition to the funds derived from direct taxes, the county receives from the state gasoline tax fund, each quarter, an apportionment for use in maintaining the roads. Some of this is then apportioned to the organized cities in the county, according to the mileage of streets connecting with county roads.

A budget is prepared by the county engineer each July and filed with the county clerk, who, compiling reports from all departments into one budget, submits the same to the Board of County Commissioners.

The Board then fixes the levy as they see the needs of the various county departments. The levy is then used by the county engineer to estimate the funds available for the next year. This, with the amount received from the state from the gasoline tax, makes the total available funds. The next step is to arrange a breakdown of the anticipated expenditures by general classification, such as (a) salaries, (b) gas and oils, (c) repairs, (d) new equipment, (e) materials, (f) office expense, (g) miscellaneous, and (h) reserve for disasters.

In addition to the above, we then set out the proposed amount to be expended each month or at least the maximum amount we might spend in any given month. This is necessary, as certain seasons require greater maintenance expenditures than others; and also during certain months repairs to surfacing can be done more advantageously than at other times.

Effect of Designing to Resist Seismic Force

The two tanks shown have the same capacity—500,000 gal.—and were built by the same company—Chicago Bridge & Iron Co.; but the one on the right was designed to resist a lateral or seismic force of 0.1 gravity, which accounts for the use of short panel lengths and rigid cross bracing, which give the tower a massive appearance.

Both are located at airports, hence the "protective coloring." The depth of the ellipsoidal bottom of the one at the left is ¼ the diameter, of that at the right 1/3 the diameter.

500,000 gal. tank at MacDill Field, Florida.

500,000 gal. tank at the Tucson, Ariz., airport.

Camp Edwards Sewage Treatment Plant

(Continued from page 12)

sixteen of them are 60 ft. wide and six are 20 ft. There are no underdrains. Transfer of sludge to the beds is through 8-in. cast iron lines.

Other Equipment. Chicago Pump Co. pumps are provided for recirculation, there being three of these with capacities of 1,000, 2,000 and 3,000 gpm., respectively. A Venturi meter is placed in the discharge pipe from the pumps to measure the recirculated flow. Duplex plunger type pumps are used for handling sludge. Buildings include an administration house containing a laboratory, blower room and office; and a service building.

Photographs are by courtesy of the Link-Belt Company.

Special Runway for World's Largest Plane

By RAY D. SPENCER
State Director of Operations, PWA of Southern California

THE B-19, the biggest bomber ever built, made its test flight last summer at Clover Field, Santa Monica, Calif., taking off from a special portland cement concrete runway built by the WPA of Southern California. The plane weighed 100,000 pounds, and taxi tests and highway engineering experience had demonstrated the need for a rugged and heavy type of runway.

Completed, the Clover Field runway is 200 feet wide and 3870 feet long, constructed in 12½-foot strips of 9-6-9 inch cross-section, with each strip thickened at the edge. Adjacent slabs were keyed together by a tongue-and-groove made by bolting a 1-inch wooden strip to the steel forms. This provided sufficient thickness of tongue and permitted spading the concrete beneath it.

No expansion joints were placed in the runway, nor was any select material used on top of the wetted and rolled subgrade. Dummy contraction joints were spaced every fifteen feet. The dummy grooves were made by driving a quarter-inch by 2-inch metal bar into the pavement. A wooden guide, made of 2 x 6's with a slot between them, was used to facilitate insertion of the metal bar.

All longitudinal construction and transverse dummy contraction joints were edged with a short radius—one-eighth inch—edger, which materially improved the riding qualities of the runway. Pilots report that this careful edging has completely eliminated any tendency of the plane's nose wheel to "hang up" on the longitudinal joints.

In order that the plane should make its test flight on schedule, construction was hastened by the WPA on the new concrete runway. Actual placement of concrete began May 1 and the 3400-foot section from which the B-19 took off was completed June 16. Two 27-E concrete mixers worked 8-hour shifts daily. Aggregates were handled from stock-piles which were located either on the grade or on the finished portions of the slab. Concrete was finished first with a mechanical finisher, second with a longitudinal float and then transversely with long-handled floats and, finally, by belting and burlap drag.

When the plane made its test flight, 3400 of the runway's 3870-foot length had been completed. The last pour had been made only 11 days before the flight, although the central portion had been finished 28 days. Prior to the flight, the bomber had taxied on the runway for several days. Although the concrete had not, of course, attained its maximum strength, there was no evidence of distress, despite the tremendous weight of the B-19.

CAPTIONS FOR CUTS AT THE RIGHT

Concreting materials were stock-piled on the finished slab or on the grade and wheeled to the mixer.

Preliminary finishing was mechanical. Slabs were laid in alternate 12½-foot lanes. Note the key at the longitudinal construction joint.

Long-handled floats followed the longitudinal bull float.

Mechanical finishing was followed by the use of a bull float.

Final finish was given the concrete with belt and burlap drag.

Cost of the concrete paving per cubic yard was as follows: Material $4.857; equipment, $0.541; labor, $1.568; total, $6.966 per cubic yard. This is equivalent to approximately $1.30 per square yard.

Instrumental in the designing and construction of the runway were H. B. Carter, City Engineer of Santa Monica, sponsor of the project; the late V. R. Seawell, then State Director of Operations for the Southern California Work Projects Administration; Ray Walker, District Engineer of Operations, WPA, and J. L. Reed, WPA superintendent on the job. WPA participated in the project under the supervision of Henry Russell Amory, State Administrator.

How to Apply for an Army Commission

(Continued from page 6)

Mental preparation is the first step. Consider how much chance you would have of getting a job if you went to the employment manager of a very large company and said: "I want to work for this company. Surely I can help you. Tell me where I am needed." The Army is an immeasurably bigger organization these days than any other in this country. No one man knows or can know where you would fit best. Each officer may know his own work, but he cannot be expected to know the needs of every other organization in the whole Army. He is too busy for that.

Therefore, the first step is for you to decide, on the basis of sound thought aided by a little research into Army organization, where you will fit best. Most of our readers are technical men, and many of them are also trained in infantry, artillery or other branches through R.O.T.C. Consider these elements and what type of experience you have had during the past five years or so. Give the same thought and consideration to your application as you would to an application for a job.

Having thus decided where you will fit best—that is, the kind of work you want to do and believe you *can* do in the Army—apply for that work specifically. It may be with the Corps of Engineers, with the Quartermaster Corps or with the Sanitary Corps; perhaps with the Air Forces. Address your letter to the Chief of Engineers, The Quartermaster General, The Surgeon General or the Chief of the Air Forces, Artillery or other branch. It will reach the right man quickly. Official correspondence is always better than personal.

In your application state your age; training in detail, with degrees, and experience. If you have held a commission previously, say so. Emphasize those factors that will strengthen your application. Do not try to prove you are a specialist in all known branches of engineering. A man that knows all about water works, sewage treatment, highway construction, bridge design, general construction, architecture, flood control and a few other assorted specialties—well, he's probably too smart to fit into the Army, especially if he has attained all this knowledge by the time he is 28 or 30 years old.

A word to the older engineers: War is a young man's game. Despite your natural and laudable desire to be of service, remember that some people have to stay at home and do the every-day and prosaic work of making sewage plants run, maintaining (and building) roads and operating water plants. Age and rank go together. A 2nd Lt. 50 years old doesn't fit, and it would not be fair nor good policy to bring in men at high grades over the heads of those who already have had some years of service. You can do your share at home, even though you may desire to be nearer the front line.

Safeguarding Water Supplies During War Time

Among the hazards considered in the article appearing in this issue on "Wartime Protection of Water Supply Systems" is that due to contamination of water by bacteria and warfare gases. Bacterial contamination is best neutralized by carrying an adequate chlorine residual throughout the entire distribution system, and confirming this by frequent checks.

Contamination with warfare gas will rarely, if ever, prove a health problem, despite general opinion to the contrary. If present, it can be removed largely with activated carbon and sedimentation. It is recommended that the following precautions, which are believed to be adequate, be observed: Make daily or more frequent tests for chlorine residual throughout the system. When a dosage of 5 p.p.m. of chlorine, above that normally required, fails to produce a residual, an immediate investigation should be made. If the chlorine demand reaches 10 p.p.m. above normal, the water should not be used. Make daily or more frequent tests for tastes and odors and investigate at once any unusual occurrence. The oxygen consumed test is also a good indicator, and a value 5 p.p.m. above normal should disqualify the water. Keeping on hand a supply of activated carbon, chlorine or chlorine compounds, chlorine application equipment and a coagulant is desirable.

Important to Users of Liquid Chlorine

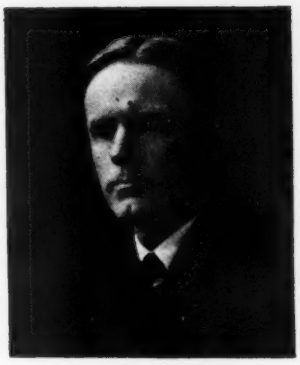
All users of liquid chlorine are given ratings. Domestic water and sewage treatment are given the high rating of A-2; for use for treating industrial water the rating is A-10. On and after February 1st, no liquid chlorine can be delivered by producers or distributors except as authorized by OPM; and orders for chlorine must be placed with producers by the 10th of the month preceding delivery date, or by the 5th of the month if placed with distributors. All orders must be accompanied by a form PD-190, which must be executed in duplicate. On the basis of these forms, OPM will decide each month how much chlorine may be furnished to each consumer, and producers and distributors must govern themselves accordingly in filling orders.

The Sewerage and Waterworks Digests

Readers of our "Digests"—and we hope that includes all who receive PUBLIC WORKS—will notice that in this issue they are set two columns to a page instead of three columns as heretofore. We are making this change at the request of a number of readers who save all the digest items and file them in a card catalog; and the 3-column width, they say, is not so convenient for this purpose as is the 2-column. Also the pages are so made up that digest items do not appear on opposite sides of the same sheet, making it possible to use all of them in this way. We will appreciate comments from our readers on this change, whether they prefer the new 2-column or the previous 3-column width.

Maintaining Gravel Roads in a Dry County

By D. W. CHESLEY
Highway Superintendent, Hughes County, S. Dak.



D. W. Chesley

IN A COUNTY where the total annual rain and snowfall amounts only to about 15 inches of moisture in all, the maintenance of gravel roads so that they are always suitable for travel is often, or usually, a difficult problem, since moisture is necessary to prevent raveling.

When the original gravel surface is placed on the subgrade, a screen analysis is, of course, always made to determine the characteristics of the gravel and the amount of voids. Enough clay is added, and incorpoporated into the gravel to fill the voids and, through semi-stabilization, produce a stable road surface. This mixture, with sprinkling or rain during the process of placing makes a suitable road, but the difficulty is to keep the surface in this form. Several conditions contribute to the separation of the ingredients and the provision of a difficult problem in maintenance.

Blading the gravel over the roal.

The passage of vehicles over our gravel surfaces in dry weather causes a separation of the fine particles of the filler from the gravel. The wind blows these fine, loose particles off the road. As a result, the surface corrugates under travel. More and more fine material is lost and more coarse material remains than is desirable. In some cases, it is necessary to replace some of the fine material before we can get a packed surface; and this is so expensive we usually have to get along with what we have to work with.

Our method of treatment is as follows: We take a good motor patrol and cut the corrugated material out, being sure to get to the bottoms of the corrugations, and windrow it along the shoulder of the road. In dry weather we cannot bring all of this material back into the road, so the most of it is left in windrows at the shoulders until rain comes. However, a small amount of material can be bladed back into the road and spread evenly over the surface, but care must be taken not to spread enough to create a traffic hazard. Small piles of gravel with binding are dangerous to travel.

If plenty of moisture happens to be available at the right time, perhaps all the loose material can be bladed back into the road and a finished job done. During or immediately after a rain is the best time to do the work, depending on how soft the road bed becomes. However, it is necessary to do a great deal of blading during dry seasons at which time the road surfaces corrugate quickly under traffic. Under these conditions, we simply have the job of moving the material back and forth and cutting out the corrugations. Blade cutting edges must be kept sharp to do this work quickly.

Gravel roads have their place in the scheme of things, and where the traffic is not great they provide a good all-weather road from farm to market, but when the cost of maintenance and of gravel replacement reaches a figure that is greater than the interest on the cost of modern hard surface roads, the economic limit of the old gravel road is, in my opinion reached, and other surfaces should be utilized.

This county has 243.5 miles of county roads to maintain and our funds are very limited. By taking advantage of WPA we have been able to place gravel on our roads for about 20 cents per yard.

Cutting out ruts and corrugations.

This modern Austin-Western Patrol Sweeper has made Princeton a much cleaner town.

The happy expression on this street sweeper's face is caused by his promotion to operator of the new mechanical sweeper.

Mechanical Sweeping Versus Hand Sweeping Of Public Streets

By I. RUSSELL RIKER, Borough Engineer, Princeton, N. J.

A year's experience with mechanical sweeping, compared to that of many years with hand brooms, demonstrates the great advantage of the former.

FOR many years the Borough of Princeton, N. J., has cleaned its streets by hand, with the exception of a short period in the early twenties when it used one of the large and expensive sweepers of those days until it broke down. In 1940, the Borough purchased a small sweeper which we have used for a year and the results lead us to believe that we will continue using the mechanical sweeper. Incidentally, our new sweeper is not only insured against property damage and public liability, but also by collision insurance, so that if the sweeper should be damaged badly in an accident it is properly covered.

The Borough's road mileage is as follows:

Semi-public roads	1.30 miles	Not cleaned
Borough maintained roads	17.07 miles	Public Roads, 20.13 miles
State roads	2.53 miles	
County roads	0.53 miles	

All public roads are cleaned by the sweeper, but a good job can be done only on those streets having curbs, or about 18.5 miles, a total of 37 curb miles to be cleaned. The types of our public roads are as follows:

Oil macadam	8.11 miles
Bit. concrete	4.93 miles
Concrete	2.44 miles
Kyrock	1.21 miles
Asphalt block	1.14 miles
Oil penetration	1.89 miles
Sheet asphalt	0.30 miles
Brick	0.09 miles

All our public roads are permanently or semi-permanently improved. The oil macadam is an ordinary water bound macadam road that has had several treatments of surfacing oil and 3/8-inch stone, over a period of years.

Truck picks up sweepings from side streets where they are deposited by sweeper.

Hand Sweeping

It has always been our policy to sweep our main business section by hand each night. A faithful employee did this for years with a cart and a push broom. He dumped sweepings in excavations on vacant lots and burned the combustible material; but later, as vacant lots became fewer, cans were placed, two in a block, along the curb in the business section. These cans, of about 3½ cubic feet capacity, were emptied the next day into a Borough truck and carted to the incinerator or the municipal dump.

This employee was able to cover only about 3/5 of a mile or about one curb mile, starting at midnight, after the traffic had died down and parked cars had been removed from the streets, and sweeping until six or seven o'clock the next morning. As the size of the business district increased, he was not able to cover the entire area each night and some nights, particularly during the week-end, he was given an assistant for part of the night. He covered most of the sidewalks in

the business district and in so doing caused some merchants to depend too much upon the Borough, resulting in the sidewalks being unswept during the day. An attempt was made to clean the remainder of the town once a week, but this was not always done, particularly during the fall season when the leaves fell. Princeton Borough has 2,625 Borough trees and as many more in back of the property line along the street. These trees always caused a grave problem. In past years it has been the practice for property owners to gather the leaves and burn them on the public streets, but the smoke was a nuisance and caused a serious accident, and as streets were improved with bituminous materials it became necessary for the Borough to prohibit burning leaves on the street without the permission of the Borough Engineer. (These permissions were rarely granted). Because of the prohibition of burning it became the obligation of the Borough to collect the leaves in the street and even permit property owners to place their leaves from their yards on the curb for collection. The collection and disposal of the leaves has been an expensive item in street cleaning, amounting to as much as $1,000 per season. The leaves were swept in piles by hand and then loaded into Borough trucks. They have been saved to use in compost piles to serve as fertilizer.

From four to six men were employed for street sweeping, with a larger gang at the end of the week. With this method, in 1937, 808 curb miles were covered at a cost of $7.54 per mile including the disposal of the sweepings; in 1938, 839 curb miles were covered at a cost per mile of $7.46; in 1939, the number of miles swept was increased due to the construction of Palmer Square and other similar improvements, making 1204 curb miles cleaned at a cost of $6.05. In January of 1940, 50 curb miles were cleaned at a cost of $5.11; in February, 44 curb miles at a cost of $9.50; in March, 72 curb miles at a cost of $6.58; in April the mechanical sweeper was purchased.

Mechanical Sweeping

It took a great deal of preliminary work during at least two years to convince the governing body that mechanical sweeping was advisable. The arguments against mechanical sweeping were as follows:

1. It would throw out of work several men doing hand sweeping.
2. The experience of an earlier mechanical sweeper indicated to the governing body that it would be too costly to repair and to operate.
3. That an experienced operator was necessary.

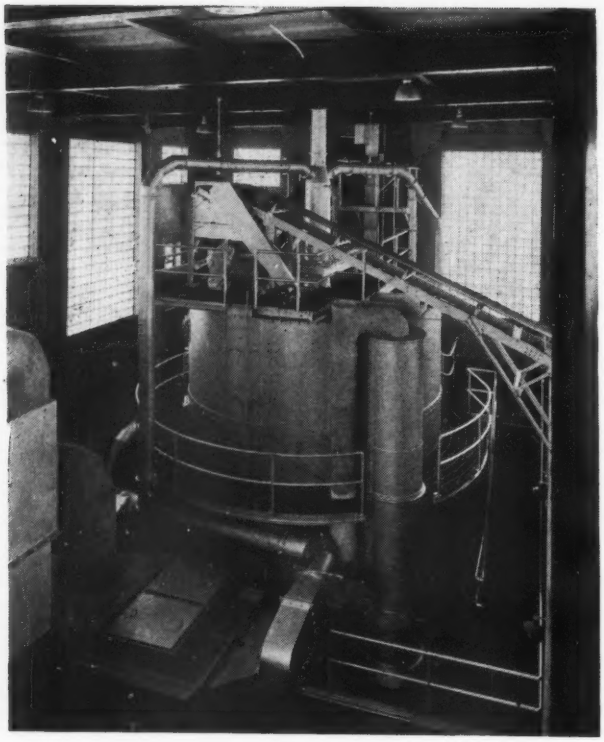
The mechanical sweeper immediately began to show results. The first month, April 1940, it swept 283 curb miles at a cost of $1.39 per curb mile and during the nine months remaining in the year, swept 3,305 miles at a total cost of $4,800, or $1.45 per curb mile. This figure included everything, even the picking up and disposing of the sweepings, with the exception of the depreciation on the machine, which we estimate to be about $500 per year or $0.15 per curb mile, making the total cost of cleaning $1.60 per curb mile. The life of the machine is figured at five years, but with proper care it should last much longer.

This figure seems high and is higher than we were given to understand by the manufacturer of the machine, but we again point out that the cost includes picking up the material and disposing of it, particularly the leaves. During October, the leaf season, the cost of cleaning was $2.09 per curb mile, while the minimum cost during the remaining nine months period, when little material was picked up, was $0.71 per curb mile. The machine has a leaf broom which pushes the leaves along the gutter in front of it, greatly reducing the cost of collection. For instance, the cost in October 1940, was $804.91 as compared to $881.75 in 1939, with a much better job done by the mechanical sweeper and with no complaints in 1940 as compared with 1939, when numerous complaints were received.

Refilling the rotary sweeper broom.

A schedule has been laid out for mechanical sweeping, with the town divided into six districts. Each night one of the six districts is swept, along with the business section. Twice a week our important through thoroughfares are swept. This makes two curb miles each night for the business section, three curb miles for the important thoroughfares and seven curb miles for the residential district or an average of twelve curb miles cleaned each night. We started in sweeping soon after midnight, but after receiving a number of complaints, particularly in the residential section because of the noise (the sweeper must run in second gear most of the time), we waited until five o'clock in the morning to start sweeping, first doing the business district, then the through thoroughfares and finally the residential section. Sweeping cannot be done satisfactorily with cars parked along the curb. The sweeper dumps the material on side streets near the curb and, starting at eight o'clock in the morning, two men with a truck gather these sweepings and cart them three miles to the municipal dump. The size of the dumpings vary, averaging about 1/3 yard; the average of the material picked up is ¼ of a cubic yard per curb mile of street.

After the first three months, we sent the rotary sweeper broom to the factory to be refilled, costing us $20 a refill. Recently we purchased a broom filler so that it can be filled at a cost of approximately $12. Hickory was used at first as refill, then bass; but as it became hard to get bass, finally bamboo. Repairs have been slightly more than anticipated, particularly the metal shoe that drags along the ground and the rubber tires. Fortunately for us, the employee who did the hand sweeping turned out to be an excellent operator for this machine and keeps it in perfect condition. While the total cost of sweeping has been reduced only a very little, we are able to do about five times as much sweeping, which results in a much cleaner town.



The Multiple-hearth Furnace

Operating Results in

LANSING, the capital of Michigan, with a population of 80,000, has been disposing of all of its garbage since the spring of 1939 in a plant designed for combined disposal of garbage and sewage in the same plant. The experience in 2½ years of operation of this plant is described herewith.

Previous to 1939 the city's garbage had been fed to hogs, and thus had been kept separate from ashes and rubbish, as was necessary for treating it in the new combined plant also. The filled garbage cans are taken to the treatment plant, clean ones being left in their place, and are there emptied and washed. Thus the garbage is fairly fresh. However, although it contains no ashes or rubbish, it does contain bones, egg shells, occasionally tableware and other materials that digest very slowly or not at all. This will be referred to later.

In designing the new plant it seemed necessary to keep the cost as low as possible, and limit its capacity to little more than present requirements. It therefore was designed for a population of 100,000; sewage flow of 9 mgd average and 18 mgd maximum; garbage, 0.5 lb. per capita per day average, 1.0 lb. maximum.

The plant consists essentially of a Dorr Co. "Detritor"; Chicago Pump Co. Comminutor; pre-aeration; primary settling tanks with Jeffrey Mfg. Co. sludge collectors; activated sludge, using Roots Connersville blowers; final settling tank with Hardinge mechanism; Jeffrey garbage grinders; four fixed-cover digestion tanks 60 ft. diameter by 26 ft. deep equipped with Dorr mechanism; Oliver vacuum filters, the dewatered sludge from which is dried or incinerated in an Underpinning and Foundation Co. multiple-hearth furnace. Also there are Simplex meters, a Wickes steam boiler, Worthington gas engine, and De Laval Steam Turbine Co. sewage pumps. The digestion tanks have a total volume of 300,000 cu. ft.; the vacuum filter-incinerator combination has a capacity of 60 tons of filter cake per 24 hrs.

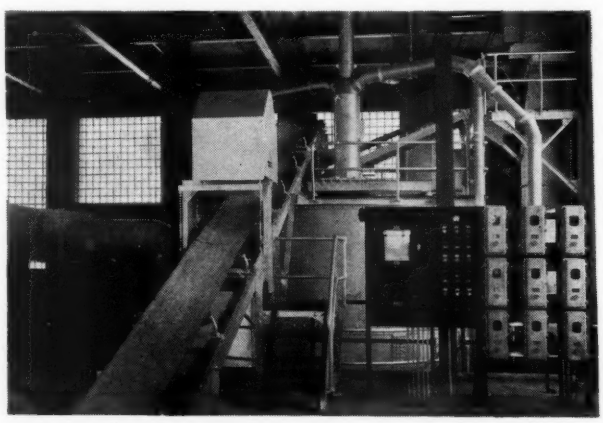
Ground garbage is not mixed with the sewage but is sent directly to the digestion tanks by pneumatic ejectors, where it is mixed with both primary and excess activated sludge. The sludge gas is used for fuel for the incinerator, and for the steam boiler which is used to supply hot water for washing the garbage cans and for plant heating.

Experimental work at Flint, Mich., had indicated that the amount of gas to be expected from digesting mixed garbage and sludge was about 2.86 cu. ft. per capita per day, or 11.5 cu. ft. per pound of dry volatile solids. At the Lansing plant, however, the amount produced has been 3 to 3.5 cu. ft. per capita, or 9.5 per pound of volatile solids put into the digestion tanks. Because of this large production of gas, the city is considering installing another gas engine to make more complete utilization of it.

Sewage sludge, garbage, and the mixture of the two as they pass through the plant, show average characteristics as follows, as compiled from monthly average records of operation from July, 1940, to June, 1941, inclusive. (The population now served by the plant is 75,000.)

	Raw primary and activated sludge	*Garbage*	*Mixture, sludge and garbage*	*Digested sludge and garbage*
Lbs. per day.....	619,000	47,600	666,600	116,500
Per cent solids....	4.69	19.1	5.71	9.30
Per cent volatile...	58.5	91.6	66.5	47.7

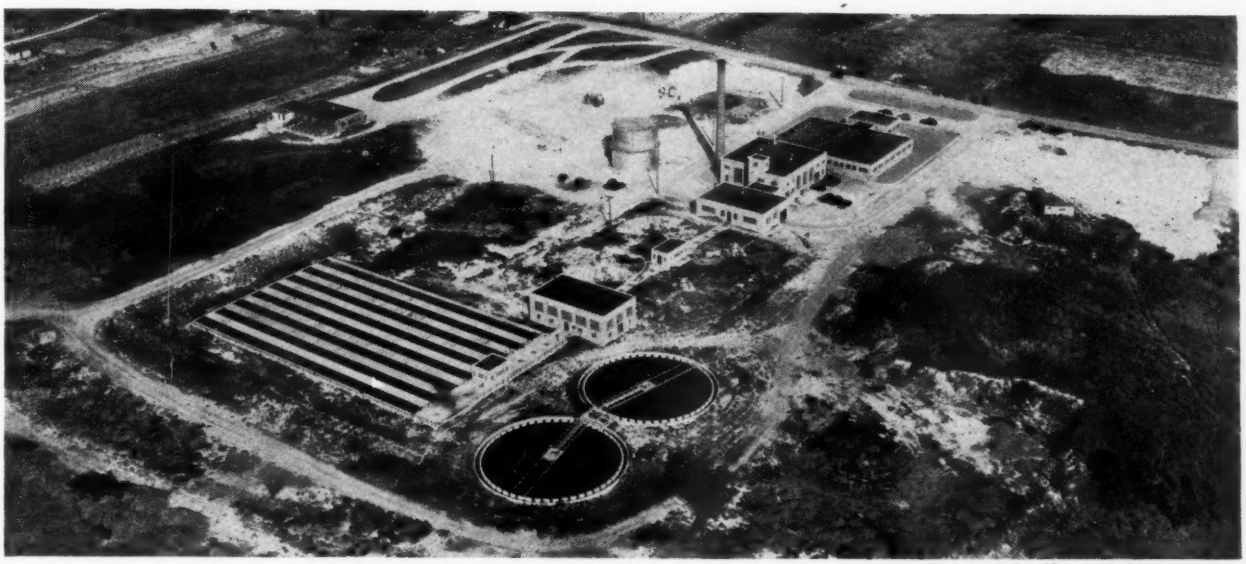
As is indicated by the preceding figures, a mixture of sewage sludge and garbage behaves in a digestion tank practically the same as sewage sludge alone. Starting with a low percent of solids content and high percent of volatile or organic solids, digestion with liquefaction and gasification of organic material produces a sludge higher in percent of solids and lower in percent of volatile solids. Digestion of a mixture of sewage sludge and garbage, however, starts more



Sludge elevator and weigher at left, control panel at right foreground, incinerator at rear.

ansing's Combined Garbage-Sewage Disposal

Two and a half years' operation of a plant disposing of all the garbage of 75,000 population, combined with its sewage, demonstrates the economy and general desirability of the process.



Photograph by Abrams Aerial Survey Corp.

General view of Lansing's combined garbage and sewage disposal plant.

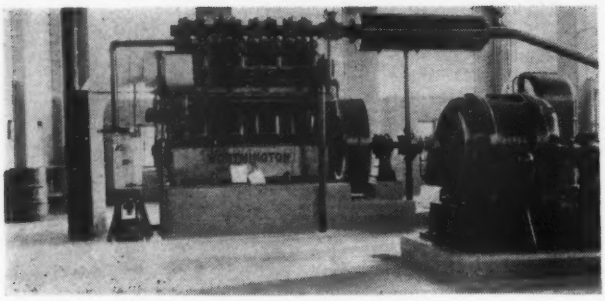
quickly and proceeds more rapidly by far than that of sewage sludge alone. This is evident from the immediate increase in gas from a digestion tank, when the garbage is added and the decrease in gas production on Saturday and Sunday with the discontinuance of garbage collection. This very rapid digestion of the garbage is no doubt due to the high volatile content of the garbage solids and their relative freshness. When digested, the sludge and garbage mixture differs from ordinary digested sewage sludge only in that it contains more inorganic solids.

During digestion, however, considerable difference is noted. Where sewage sludge alone will ordinarily settle to the bottom of a tank, allowing a fairly clear supernatant liquor to be taken off from the top, a mixture of sludge and garbage digests so rapidly and gives up so much gas that solids are carried up to the surface and a good supernatant liquor is sometimes impossible to obtain. The four tanks at Lansing have been operated in parallel, each one independent of the others. With the frequent addition of fresh sludge and garbage, digestion is maintained almost constantly at a rapid rate. Tests have shown thick sludge at the bottom of the tank and progressively thinner sludge upwards to the very top. The so-called supernatant liquor instead of being clear often contains 2% or more of solids. Removal and disposing of such supernatant liquor is a problem.

Experimental work carried on over about a year's time shows that, after the first rapid digestion has taken place, the sludge, if allowed to stand without the addition of any new solids, soon separates from the liquor quite completely and it is possible to draw off a fairly clear supernatant liquor. This liquor will not be at the top of the tank, however, but may be in a zone in the middle or higher. Drawing off the liquor, therefore, can be accomplished best by the use of some sort of adjustable draw-off pipe rather than by a fixed supernatant draw-off pipe as found in most plants.

This experimental work also has developed the fact that the best way to digest a garbage-sewage sludge mixture is by stage digestion. Four tanks were used in series, sludge and garbage being placed daily in the first tank, mixed thoroughly and allowed to stand for nearly 24 hr. Then some supernatant liquor was removed and part of the sludge transferred to the second tank, and its contents thoroughly mixed and allowed to stand for a day; and this procedure was repeated for the third and fourth tanks, the sludge being held for a longer period in the fourth tank. Both sludge and supernatant were progressively better as they passed from tank to tank, the sludge in the fourth tank being ready for drying.

As a check on the performance of the experimental tanks, they were operated for several weeks in parallel just as the plant tanks were, and it was found that a capacity of 4 cu. ft. per capita should be provided for parallel operation but only 1.7 cu. ft. was necessary



Gas engine blower unit.

for similar results by series operation. Filterable sludge, properly digested for handling, could be obtained in 15 or 16 days.

Size of digestion tank is not the only consideration in designing a plant for combined treatment. Inorganic garbage solids may clog piping and tank mechanism; provision must be made for drawing off supernatant at different elevations; also for maintenance and overhauling of the equipment.

The difficulties experienced in operating the Lansing plant have been mainly mechanical ones. The worst is caused by presence in the garbage of bones, egg shells, glass, bottle caps, utensils and other solids, and fruit pits in great numbers during the fruit season. These pass through the tanks readily but clog sludge piping and accumulate in valve bonnets, fittings and pumps. Fine egg shells gradually fill a pipe line so tight that it has to be rodded out. Fruit pits, being rough and sharp, not only lodge in piping and equipment but tear the cloth of vacuum sludge filters. This of course could be prevented by passing the ground garbage through the grit chamber and tanks with the sewage. This has been done at Lansing during the fruit pit season; but it not only puts a heavy load on the grit chamber mechanism and primary tanks but also overloads the activated sludge process because of the added organic material in solution contributed by the garbage; also there is a very marked decrease in the amount of gas produced.

Some of these troubles can be avoided or lessened by using plug-type valves rather than disc type, and using sludge pumps with capacity great enough to maintain velocities in the sludge pipe high enough to prevent deposits of solids. A solids catcher might be devised, somewhat similar to a mechanically operated grit chamber, through which the ground garbage mixed with a considerable amount of water could be passed before going to the digestion tank. Pipe lines should be as short and direct as possible, with ample provision for flushing them out.

Two and a half years' operation has shown how improvements can be made to the plant which will increase its efficiency. Piping changes will permit use of the four digestion tanks in series and drawing off supernatant from different elevations. Sludge will be passed rapidly from one tank to another to prevent deposits; and after quickly mixing it with the contents of the second tank it will be allowed to settle before the supernatant is drawn. Instead of resettling excess activated sludge and supernatant in the primary tanks, three small, long-detention-period settling tanks will be provided, the thickened sludge from which will be put into the digestion tanks, while the supernatant will go to the activated sludge aeration tanks. This will relieve the load on the primary settling tanks and reduce the amount of water carried to the digestion tanks.

The first cost of the Lansing sewage-garbage disposal plant as built in 1938-39, complete with all engineering and miscellaneous costs included, was $785,000, or $7.85 per capita of designed capacity. The additions now made and contemplated will add approximately $75,000 and bring the cost to $8.60 per capita of designed capacity, or $11.50 per capita of present connected population.

The cost of operation for the fiscal year of 1939-40 was as follows:

Labor and supervision	$32,000
Power, light, water	25,600
Chemicals	6,300
Maintenance	2,600
Supplies and miscellaneous	3,800
Insurance	2,500
Total	72,800

This operating cost represents a unit cost of $.97 per capita per year and includes the disposal of sewage in a complete treatment plant and the disposal (but not the collection) of all garbage.

Since the construction of this pioneer plant at Lansing a number of cities have built or decided to build combination plants to handle both sewage and garbage and other cities have considered adding facilities for grinding and digesting garbage to existing sewage plants. The value of this method of disposal of two municipal wastes has been demonstrated, and can be measured in terms of savings in operating cost for labor, due to centralization of activity in one plant, instead of two, and for power supplied by digestion tank gas. Furthermore, it is a clean, sanitary method of disposal which avoids nuisance and public criticism. The disposal of garbage in an existing sewage plant or the design of a new combination plant should be approached, however, with caution and careful consideration of all local conditions in order that mechanical difficulties may be avoided.

The material in this article was presented by Mr. Drury as a paper before the Public Works Congress, at New Orleans, La., in October, 1941.

Effect of Carbon Black on Strength of Concrete

A small amount of black colloidal pigment may be added to portland cement concrete to improve its appearance and to reduce glare. Carbon black is the pigment generally used.

To determine the effect of carbon black on the strength of concrete at ages up to 1 year, a series of tests including both tension briquets and 2-inch cubes for compressive strength tests was made by the Division of Tests of Public Roads Administration.

The results of these tests indicated that to an age of 1 year, none of the samples of emulsified carbon black tested caused any important reduction in the strength of the mortar. The tensile strength test appears to be preferable for use in determining the quality of samples of carbon black, and a strength ratio of 90 percent appears to be a suitable minimum value in such tests.

Help Defense—Stop Accidents

According to the Ohio Dept. of Highways, "Nazi raids on England killed 42,230 persons in the year ended June 30. Accidents in the United States killed 97,500 persons—more than twice as many—in the same period!" "The labor lost by workers killed and injured in traffic alone during the first seven months of 1941 could have built 20,000 fighter planes or 50,000 light tanks or 12 battleships."

Part of the chemical laboratory, Buffalo Sewage Treatment Works.

Third Year of Sewage Treatment Operation at Buffalo, New York

By CHARLES R. VELZY, JOHN W. JOHNSON, and GEORGE E. SYMONS
Respectively Works Superintendent, Asst. Works Supt., and Chief Chemist,
Buffalo Sewer Authority, Buffalo, New York.

MUCH has been written concerning the Buffalo Sewage Treatment Works, its design and construction[1, 2], its functional processes,[3] its early operation[4, 5, 6, 7, 8], its effectiveness for removing pollution from the Niagara River[9, 10], its studies on sewage chlorination,[10, 11, 12] and other reports on experimental studies[13, 14, 15]. But although these reports have presented some operating data, they have perforce been in the nature of preliminary information because no new treatment plant completely establishes normal routine operations in the first two years. For that matter, the characteristics of the sewage are likely not to be normal in the first year or so, particularly if long lines of old uncleaned sewers have been intercepted. Therefore, with the completion of the third year of operation of the Buffalo plant it is of interest to present a report that may be considered as representing routine operation and results for this plant. Any future discussions of operations should await a summary of data for a five-year period after the first year's operation. The following discussion is based directly on the material prepared for the annual report of the treatment works for the fiscal year 1940-41.

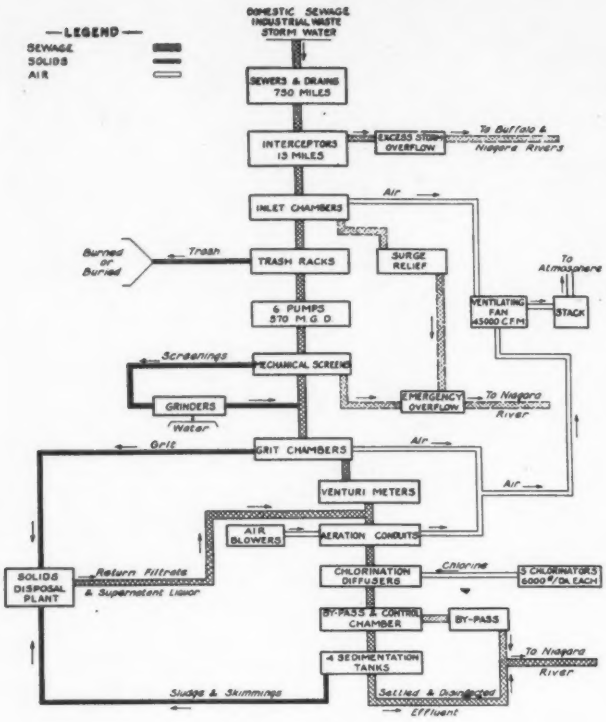
In this, the third year of operation of the treatment works, the functioning of the treatment processes has been normal and effective; operation has continued smoothly with increased efficiency and economy. Additional progress was made in maintenance, including the substitution of different materials and adjustments to equipment for prolonged life. The boundary waters were kept free from pollution to the satisfaction of the State Department of Health and the neighboring communities.

Notes on Operation

Certain phases of operation, wherein improvement was made, deserve comment. At the main pumping station a procedure of frequent flushing was used successfully to prevent excessive deposits of grit and sludge in the wet well. The flushing was accomplished several times a week by pumping down the wet well to low water level, thereby increasing velocities.

Operation of screening and grit removal equipment has been changed from continuous to intermittent, adapting the operating cycles to the load. This reduces wear on equipment and simplifies operation to some extent. Washing of grit was improved by changes in weirs, and overflow pipes and installation of water jets in the grit washing equipment.

In the operation of the settling tanks, study was continued on the inlet baffling arrangement for the



Flow sheet; sewage treatment.

purpose of obtaining better efficiency at higher flows. In the previous year, experiments had been begun on two tanks, using inlet baffles of eight and four feet depth; this year the baffle from the third tank was removed. Results of studies now indicate that a shallow center baffle, slotted, will be effective for tanks of this design. Lubrication of the driving equipment of the tank mechanism was improved by the use of an oil which would not emulsify with the moisture from condensation.

Accumulation of deposits in the sludge discharge line[4, 6] reoccurred this year. Steaming operations on this line were used again with good results and a minimum of expenditure. Pumping of the sludge from the sedimentation tanks on an intermittent schedule resulted in a raw sludge averaging more than 7 per cent in dry solids content. Plugging of sludge meters by the occasional excessive discharge pressures during sludge pumping was overcome by the installation of a booster pumps and tank to maintain higher water pressures on the meters. Greater flexibility in operation has been obtained by the installation of cross-connections on the raw sludge suction lines.

In the sludge digestion tanks, better control of scum layers was made possible by the installation of recirculation lines through the control building to the tanks. By means of these lines, it is now possible to recirculate supernatant liquor or light sludge through the gas dome on to the heavy scum layer[6, 16].

Considerable development work on the sludge incinerators was accomplished during the year. The incinerator manufacturer's representative made changes in the mixer and flash dryer operation which have aided in reducing abrasive wear. The induced draft fan on one incinerator unit was relocated to operate on the clean air side of the fly ash cyclone, thus reducing abrasion of fan blades and liners. An experimental gunite lining was installed in the two cyclones of one incinerator unit in place of the original steel lining. The cost was considerably less than that of steel lining. The installation was reasonably successful and tests have been made to determine the most suitable aggregate and cement for this purpose. Gunite will probably be used on all cyclones. Interesting experiments were carried on with fan blades, leading to the use of arc welded, narrow lines of beads on the fan blades, to effectively reduce abrasion.

In sludge dewatering filters, the use of sash cords in place of the original brass bars as a means of fastening the filter cloth to the filter drum has cut the time of reclothing a filter by more than half. During the year the wooden deck and wire screen on the surface of the vacuum filters were cleaned of calcium carbonate incrustation by means of an acid bath.

Laboratory Activities

The Bird Island Laboratory was again approved for bacteriological and chemical analyses of water, by the New York State Department of Health. Routine bacteriological and chemical testing of sewage samples was maintained throughout the year. Samples were collected from various general locations, as follows:

Sewage treatment works	10,452
Niagara and Buffalo rivers	455
Materials received	433
Miscellaneous	66
Total Samples	11,406

In the performance of the analytical work, 4263 sanitary chemical analyses and 5953 bacteriological analyses were made, with the remainder distributed variously. In making the 11,406 analyses, a total of 50,314 analytical tests were made, of which 40,818 were chemical tests on sewage and 6055 were bacteriological tests on sewage and polluted water. Other tests included B.t.u. tests on oil and sludge, chemical tests on lime and ferric chloride, gas analyses, gauge tests, sludge conditioning, and others of miscellaneous nature.

In the control of sewage chlorination and disinfection, 12,353 chlorine demand tests were made on samples collected at hourly intervals. Control of chlorine dosage was varied to meet seasonal conditions, and the dosage was adjusted hourly to maintain a residual chlorine content of approximately 0.1 p.p.m. fifteen minutes after dosage. Routine daily data were collected on sedimentation, sludge digestion and sludge conditioning, dewatering and incineration. Inventories of the sludge tanks were taken at monthly intervals. Gas analyses were made weekly, as were B.t.u. determinations on sludge cake composites.

Regular monthly stream pollution surveys were made on both the Buffalo and Niagara rivers. The data on the Buffalo river, which receives industrial waste, indicated that increased productive activity of the plants had apparently offset corrective measures instituted by some of the industries.

For the condition of the Niagara river below the sewage treatment works, the following table shows the average results at points approximately 6 and 16 miles below the outfall.

	UPPER BRIDGE, 5.8 miles below outfall		*LOWER BRIDGE, 15.7 miles below outfall*	
Years	*Coliform per ml.*	*% Reduction from 1936-38*	*Coliform per ml.*	*% Reduction from 1936-38*
1936-38	323	—	134	—
1938-39	122	62.0	77.6	44.0
1939-40	10.3	96.9	18.1	87.0
1940-41	7.1	97.5	14.7	89.0

(Continued on page 50)

Tunnels for Increasing Honolulu's Artesian Water Supply

WATER supply is a most important problem in the island of Hawaii. Agriculture requires the use of practically all the water except that which reaches the artesian strata, so that the city of Honolulu has adopted the policy of not going outside the District for its supply until absolutely necessary. This means developing all water sources within the district to their utmost extent, and reducing to a minimum all waste or unnecessary use of potable water, whether provided by the public supply or obtained through privately owned artesian wells.

Normally, about 90% of the city's supply is drawn from five artesian areas that underlie the city and the remainder is supplied by springs and tunnels in the valleys of the Koolau mountain range back of the city. Rain falling in the mountains and foothills reaches the artesian areas by infiltration. The city is now drawing 34 mgd from this source, 20.5 by the city system and 13.5 by privately operated wells. How much more it is possible to obtain without risk of intrusion of salt water is a problem now being studied. Mountain springs and tunnels can usually be counted on to deliver about 4 mgd, but in 1939 this fell to 2.91 mgd.

Conservation of the city's supply is aimed at by reducing unnecessary consumption and stopping distribution system leaks and leakage from artesian wells. To effect the first, the services are 100% metered and there is a regular schedule of testing each of the 24,000 meters once every five years. During the past ten years the average per capita consumption (from both public and private supplies) has been reduced from 253 gal. to 205, or about 20%. Conservation within the waterworks system has reduced the unaccounted-for water to 12% in 1940, this including leakage from mains, under-registration, fire-fighting, cleaning reservoirs, and flushing sewers and fire hydrants.

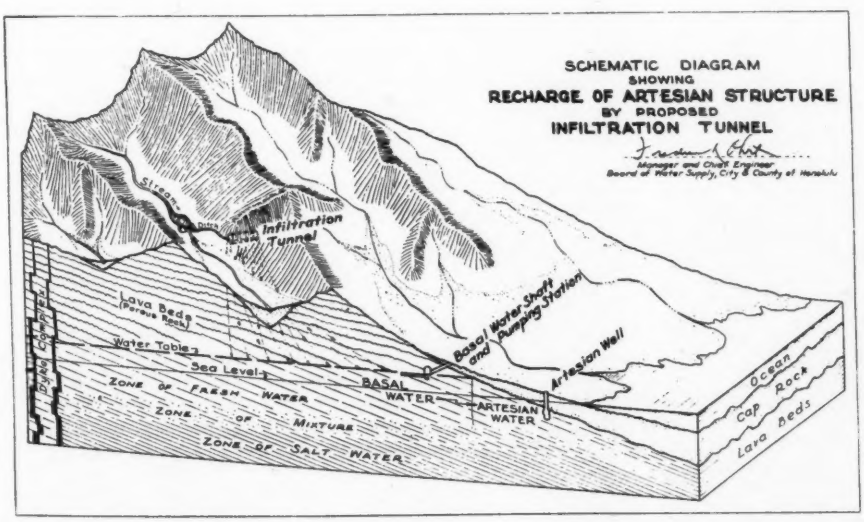
Underground leakage in well casings has been a cause of the most important loss of artesian water. Of 177 artesian wells in the city, 57 have been put out of service and sealed; and 12, whose owners were unwilling to discontinue their privately operated water systems, have been recased; with a resulting saving of 16,400,000 gpd.

The city now operates 30 wells and private owners 69; 9 being unused. Water level recorders are installed on 11 wells to record the fluctuations in the artesian water level of each of the five areas of the Honolulu artesian structure.

It is hoped that about 2,600,000 gpd of potable water can be conserved by the use of non-potable ground water for air conditioning, condensing, gas scrubbing and similar operations; this amount now being used for these purposes from 15 privately operated artesian wells.

With a view to increasing the amount of artesian water, the Board of Water Supply proposes to "divert part of the water that now runs to waste at sea in streams from the upper valleys back of the city, into tunnels driven into the mountainside on the Honolulu watershed areas. Extensive geologic and engineering studies have convinced us that some of the water thus diverted will be conserved for future use by infiltration into the artesian areas." (Report of Board of Water Supply of the City and County of Honolulu.)

As a beginning, plans were prepared and work started on one of these infiltration or "recharge" tunnels, the Palolo. The water diverted into the tunnels will, it is believed, "seep into the porous rock formation (Koolau basalt) and then percolate downward to the free water surface of the Honolulu artesian structure." The Palolo tunnel was designed with a length of 500 ft., to receive 0.8 mgd from a stream whose mean flow is 1.1 mgd. It is estimated that this will add 0.4 mgd recoverable water to the Waialae artesian area, where the need of additional supply is greatest. It also will provide experimental data to govern the design and construction of other infiltration tunnels. The cost was estimated at $20,000 for construction and $5,000 for land.



Schematic diagram showing proposed infiltration tunnel.

Three other recharge tunnels are contemplated, one 500 ft. long, estimated to cost $40,000, and two 1,000 ft. long each, estimated to cost $30,000 and $40,000 and recover 2.6 and 2.0 mgd respectively.

The accompanying illustration shows a schematic diagram of a recharge tunnel and the way it is supposed to operate.

Further information about Honolulu's water supply will be found in PUBLIC WORKS for October, 1939 (where details of well sealing are given) and May, 1937.

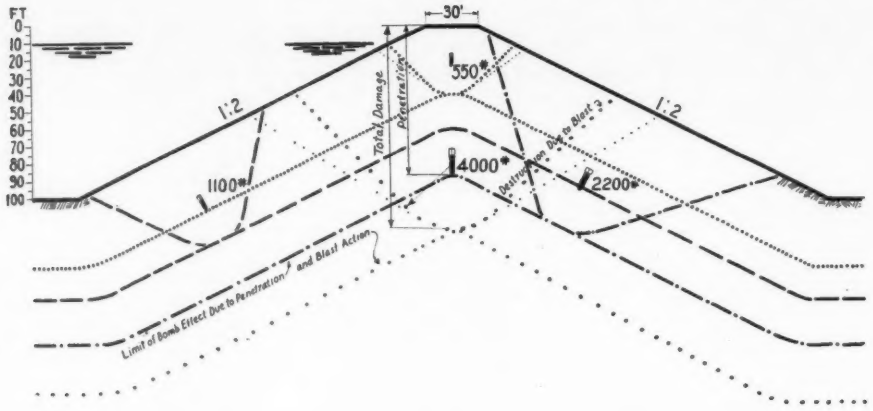


Fig. 1-a—Damage done to earth dams by bombs.

Wartime Protection of Water Supply Systems

JOSEPH D. LEWIN, Assoc. M. Am. Soc. C. E. and M. J. POPPER, Assoc. M. Am. Soc. C. E.

Suggestions, based on European experience, for preparing to meet increased demands; and for protecting dams and other existing facilities.

WARTIME protection of any public utility involves many phases, such as bombproofing, camouflaging, anti-sabotage measures, etc. Of all public utilities, water supply is that most affected by warfare. On the one hand, stepped-up industrial activity and an influx of population into large cities with its concomitant fire hazard causes an increase in demand; and on the other hand, bombing and sabotage activities tend to decrease or cripple the proper functioning of the water supply system. The methods of meeting this increased demand will be dealt with in Part I, and measures for protection of existing facilities will be dealt with in Part II.

This article is based on an intensive research of European practice. For definite reasons the authors have refrained from naming locations or dealing with any existing supply system in the United States.

Part I—Increasing the Supply

The increase in demand can be met by improving and enlarging existing water supply systems or adding new supply sources. Since the question of time is often of importance, crude methods may occasionally be resorted to. If the increased demand is of a temporary nature, non-permanent installations might be justified. The first step is to ascertain the possible future demand.

Destruction due to bombing an English city.

Industrial Demand

The vital importance of water supply in defense industry areas has been recognized by the government, and therefore materials for additions to water supply systems in such areas have been placed on the priority list in the group A-10, issued on Sept. 17, 1941, under number P-46.

The sudden increase in demand has, in some communities, resulted in the reduction of the per capita supply from 130 gpd to 50 or even 30 gpd. This is particularly true in communities which depend for their supply on storage of water, since such storages cannot suddenly be increased during the period of emergency.

Fire-Fighting Demand

No increase in water demand because of conflagrations due to the enemy has as yet been experienced in the United States. However, this problem would become very urgent if incendiary bombs were dropped over our cities—as in England a year ago, where 5,000 or more fires had to be extinguished in one night, which required about 1,000,000 gpm.

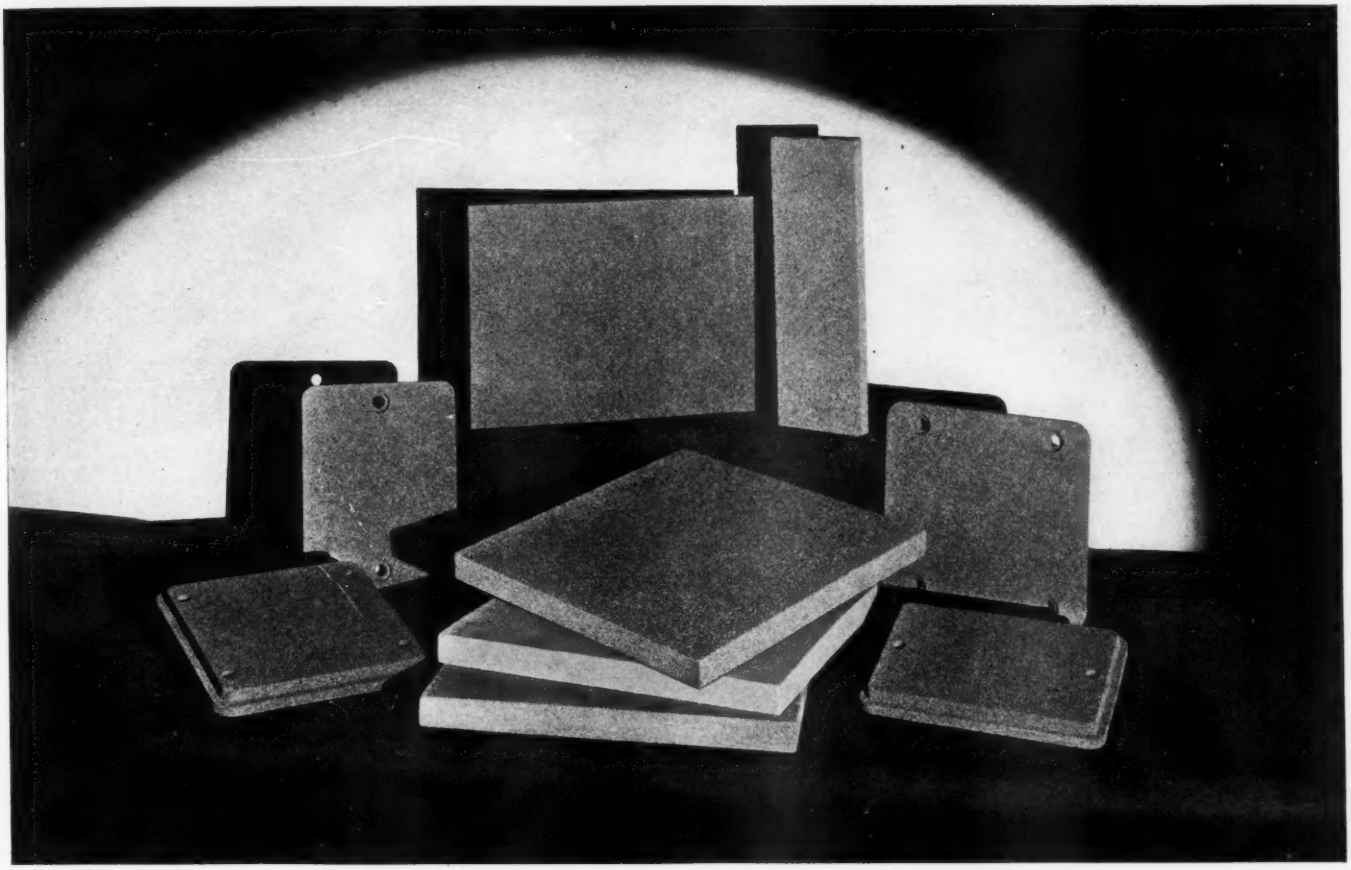
In estimating the possible water demand for fire-fighting, consideration should be given to the types of structures involved. British data:

200-300 gpm is required for a 2 story detached house.

1,000-1,200 gpm is required for a tenement house.

5,000-10,000 gpm is required for warehouses, factories, docks.

The New York City Fire Department estimates that our buildings represent a fire hazard far greater than the English, and even more than the German. Further-



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NORTON POROUS MEDIUMS

When you need special information—consult the *classified* READER'S SERVICE DEPT., pages 55-57

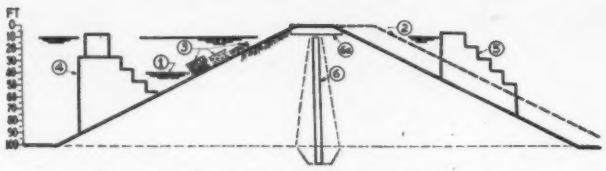


Fig. 1-b—Methods of protecting earth dams.

more, it should be noted that our cities are more densely populated than the European. An average large American community has a built-up area of about 35%, as compared with 20% in England. This condition aggravates the problem.

Existing Facilities

Additional interconnections between large mains may improve considerably the delivery of an area. A checkup of actual delivery capacity is advisable. This is effected by simultaneously opening *all* hydrants in the locality which is under investigation, and determining the pressure and quantity of water available at different times of day and night. Such investigations can be conducted by municipal authorities or by independent consulting organizations. However, it should be kept in mind that a main might have larger delivery capacity than the outflow through the hydrants; in which case additional fire-hydrants should be installed to utilize the full capacity of the mains. These additional hydrants along the line are useful because some hydrants might be damaged or buried under debris and rendered inaccessible. In placing new hydrants, consideration should be given to their most desirable position. The installation of hydrants on trunk mains or untapped distribution mains in vital areas is advisable. This measure will not increase the total delivery, but will add considerably to the delivery at critical, strategic points.

Present hydrants should be checked for their efficiency. Some might be clogged, others might operate with considerable difficulty. Such hydrants should be serviced, repaired, or even replaced.

The investigation of actual delivery capacity of the distribution system will reveal whether the pipes are clean or tuberculated. This is important because, in times when new materials required for improvement of existing facilities are scarce or unavailable, clogged pipes can be cleaned, thus increasing available pressure and delivery. At the same time this emergency measure lowers operation cost under normal conditions.

Auxiliary Sources

If all the available supply at its minimum is below the required capacity, some provision for auxiliary supply sources or for auxiliary storage should be made. Since in most cases the deficiency is in water for *fire-fighting* purposes, raw or untreated water may be used, provided it is separated from the potable supply. Any seashore, river, or lake is a potential source. Since the enemy may strike at low water or low tide, such an extreme condition should be taken as the basis for estimate. It may be recalled that London was attacked at the time of lowest tide, on a Sunday evening when a part of the population was out of town. What it meant to carry 12" hose for 200 feet, knee deep in mud, into the Thames river can hardly be imagined.

Since emergency tapping of auxiliary water supply sources might require time, skilled labor, and materials, all the possibilities should be surveyed and suitable plans prepared now. In preparing these plans, special attention should be paid to a full segregation of treated water and untreated water systems.

Any natural or artificial body of water can be utilized. Lakes, rivers, canals, tidal basins, ponds, abandoned wells, and the seashore present an unlimited auxiliary water source. However, the tide conditions, inaccessible or unsuitable approaches, and other difficulties may hamper and delay the emergency work. An investigation will reveal whether portable pumps could be placed on boats, floats, rafts, or piers or even under the piers, and how effective such measures will be. A simple emergency intake may consist of an empty drum acting as a pump. A number of suction pipes placed at strategic points will permit pumps to start action quickly without approaching the waterside.

Where installation of emergency mains is not justified and the distance is relatively short (in England about 1000 feet), a large pump stationed at the source of supply may deliver directly to other pumps in the vicinity of the fire, or to a tank from which several pumps may draw.

Where distances from source of supply are greater, sprinkler trucks or large portable tanks may be used. They are filled by a pump stationed at the source of supply and emptied into a tank at the demand point. This method of conveying water may be used where the supplies in the mains fail or are insufficient. It is preferable to long lines of hose which are vulnerable and act to obstruct traffic.

Pumps normally used on construction jobs are very desirable because most of them operate with their own power unit, and are usually sufficiently sturdy to withstand rough usage. Some of these pumps, although light in weight, deliver considerable amounts of water at a small head.

Pumps can be placed in series so that the pressures are boosted from pump to pump. If fire pumps are available, they can be used as very efficient booster [illegible] possibly even at the water source. In any case, [illegible] advisable to make an actual test utilizing every auxiliary source, to ascertain the capacity and dependability of the proposed arrangement.

Industrial private water supplies such as those of breweries, paper mills, canning factories, sugar refineries, large laundries, hotels, etc., might be diverted for public use; therefore their maximum delivery should be ascertained. Caution is necessary in the use of private supplies to guard against pollution. The installation of back-pressure check valves and other approved control devices should be given consideration.

If all the available supply at its minimum is below

Building debris piled to permit traffic.

the required capacity, some provisions for storage should be made. In England, circular canvas bags and rectangular steel troughs have been installed in open spaces. The canvas bags have a 500 gal. capacity, and the steel troughs, 4′ x 20′ x 60′, have a 35,000 gal. capacity. Basements and cellars of destroyed buildings are being converted into reservoirs by waterproofing floor and walls and providing some roofing. Recent German practice is to provide important structures with their own water supply. Such supplies are operated by Diesel or gasoline engines and are independent of city power. The English method requires constant maintenance because of leakage, evaporation, mosquito nuisance and freezing. Also large quantities of water and materials are immobilized at locations where they may never be needed.

An improvement of the existing system by interconnections, valving, additional pumping and control equipment, permits reduction of storage capacity and concentration of water at centers of emergency. At the same time, the efficiency of the existing systems under peacetime conditions is enhanced.

If conditions warrant the installation of tanks, consideration should be given to the location, arrangement, type of construction, and material. The choice of material might be limited by shortages or lack of skilled labor. In addition to steel and canvas tanks, concrete, wood-stave, and brick should be considered. Portable tanks may consist of asbestos-plates, reinforced concrete plates, or corrugated sheets which are placed in demountable frames.

Part II—Protection of Facilities

Of more serious importance than the problem of providing an increased supply is that of protecting existing facilities aganst direct attack and sabotage.

Civilian defense against explosives, poisons, and bacteria may involve:

Layouts and camouflage
Structural design
Policing
Emergency maintenance
Civilian participation.

These means of defense can be applied to the principal parts of a water system, namely, the water itself; impounding facilities; intakes; conduits; treatment and pumping plants, and the distribution system.

The Water

Water may be contaminated by poisons or bacteria. Large bodies of water are less vulnerable than small bodies because of the vast quantities of poisons required to produce a dangerous concentration.

Harmful materials can be introduced by spraying, in bombs, or in containers. Since these means can be used not only by aircraft but also by saboteurs from bridges or shore lines, proper fencing, lighting, rerouting of highways and policing should be considered.

Poisons

Water may be contaminated by inorganic poisons such as arsenic compounds; heavy metals (lead, mer-

cury, barium, copper, zinc); cyanides, creosols, phenols, glucosides, alkaloids, as well as by organic war gases.

The organic gases are more potent than the inorganic poisons. Of about sixty different war gases, five groups are of particular importance:

1. Lewisite, a chlor-arsene compound—$ClCH{=}CHAsCl_2$.
2. Mustard (Yperite or Lost), a chlor-ethyl-sulphide compound—$S(CH_2CH_2Cl)_2$.
3. Phosgene, a chloride compound—$CHCl_2$.
4. Adamsite, an arsene-chlor compound—$NH(C_6H_4)_2As\,Cl$.
5. Various cyanide compounds.

Organic arsenic compounds are toxic above 0.15 ppm; cyanides at 30 to 60 ppm; mustard gas at 40 to 50 ppm.

Mustard gas, cyanides, and bromides are slowly hydrolized. Therefore, if sprayed on the surface of water, they may be dispersed by wind before they contaminate the water. However, if droppd into the water in containers with slow release, these gases might produce a toxic effect. Cyanides form in water a hydrocyanic acid, or Prussic acid, which has explosive properties. Therefore provision for venting might decrease the possible accumulation of Prussic acid.

The cyanide group can be treated with alkalis (lime); the arsene and bromide group can be treated with alkalis, hydrogen peroxide, or bleaching powder, and sodium sulphite. It is not necessary to treat the chlorine group, since it causes only an overchlorination of water.

Bacteria

The effectiveness of contamination by bacteria is a debatable question. English authorities state that it is possible to dry out and compress a ton of bacterial cultures, such as typhoid, so it will weigh 100 lbs. Such dehydrated, hibernating bacteria are supposed to be immune to chlorination until they have absorbed a sufficient amount of water, which may take 24 hours. But the British question the immunity period of dehydrated bacteria. Whether these bacteria are immune or not, the possibility of their introduction below the point of chlorination (for example at a water faucet) should not be overlooked, and provisions should be made for emergency chlorination at any point of the distribution system as through hydrants. Insuring residual chlorine at the tap presents a factor of safety, and consideration should be given to such a measure. Because of the time required for tests, the bacteria might produce epidemic condition before they have been revealed and precautions been taken.

Impounding Facilities

Since the water supply of some communities depends entirely or to a large extent on storage supply, the safety of impounding works becomes a major problem. It must be realized that if the dam is damaged, the entire water supply system might be incapacitated to a large extent. Therefore, the protection of the source warrants considerable expenditure and attention.

Small Earth Dams

A small earth dam, 60 ft. or less in height, can be destroyed by a direct hit. A 500 lb. bomb will penetrate 20 ft. to 25 ft. and tear out a hole 40 to 50 ft. in diameter, and the consequent discharge of water through the break will erode the rest of the earth embankment. Fig. 1A shows the effect of penetration and blast of various sizes of bombs in earth dams. The data are compiled in Table 1.

1. Damage in Earth Due to Penetration and Blast

Size of Bomb (lbs.)	*550*	*1100*	*2200*	*4000*	*10,000*
Penetration (ft.)	24	38	60	86	126
Blast, radius of destruction (ft.)	18	23	29	35	48
Total depth affected (ft.)	40	57	80	115	165

The extent of damage can be decreased by several methods (Fig. 1B).

1. The water level might be lowered to provide for additional freeboard. The minimum draw-down for a 1:2 sloped dam with 10 ft. freeboard and 30 ft. crown is as follows: For a 550 lb. bomb, 15 ft.; for a 1100 lb. bomb, 25 ft.; 2200 lb. bomb, 35 ft.; 4000 lb. bomb, 50 ft.

This measure will result in loss of storage capacity and head, but it does not require any new work or materials. In some cases the reservoir can be emptied, if the supply can be fed from other sources. Incidentally, such a radical measure will render a dam less attractive to enemy bombers.

2. Additional thickness provides for extra stability and consequent safety. (Table 2.)

2. Protection of Earth Dam by Widening with Additional Fill

Size of Bomb (lbs.)	*550*	*1100*	*2200*
Additional rolled-fill for a 1:2 sloped dam with a 30' crown, measured horizontally	30	80	150
If placed in sandbags	20	70	140

Such additional material can be placed by normal rolled-fill methods or by sand-bagging the downstream face. The better to withstand rotting due to moisture, the bags may be treated with suitable chemicals. The bags will increase the cost of fill material but their use permits the use of ungraded materials, eliminates use of large equipment or fill control, and can be carried out quickly under any weather conditions by unskilled labor. They are also useful in emergency repair and checking the erosion by scour.

3. The earth fill can be protected by a bomb-resistant blanket. This blanket should resist the penetration and the explosion force of the projectile. The data are given in Table 3.

3. Protection Against Penetration and Blast by Providing a Bombproof Blanket (Downstream and Upstream)

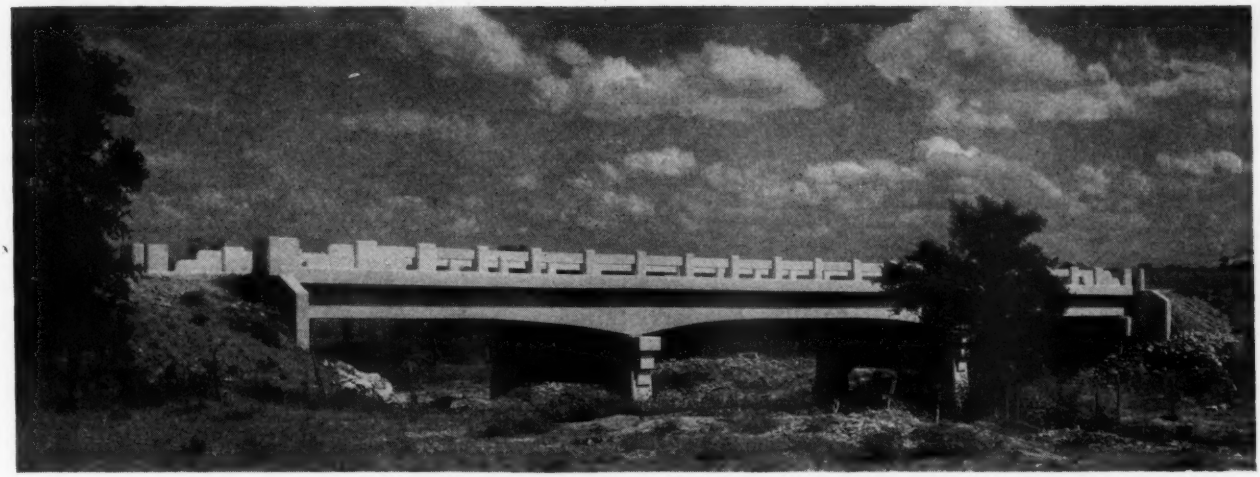
Size of Bomb (lbs.)	*550*	*1100*	*2200*	*4000*	*10,000*
Material of burster course,	*Thickness of Burster Course, in Feet*				
5700 psi concrete, specially reinforced with all-welded bars, placed in several layers	3.5	5.5	8.5	12.5	18
3000 psi concrete, not reinforced	4.5	7	11	16	23
Heavy riprap	8	12	18	26.5	38

As can be seen, for most small dams the cost might be prohibitive.

4. A coffer dam on the upstream face can be advocated in countries rich in timber. It can be placed either in the dry (when the reservoir is empty), or under water. In the latter case, skilled labor and heavy equipment are required.

5. A coffer dam may be placed also on the downstream side of the dam. In this case, the pondage is not disturbed. However, this coffer dam should be wider because of the possibility of sliding, and eventually should be anchored.

6. In designing new small earth dams, the advisability of incorporating partition walls to confine the damage to one or two sections should be considered. A steel or reinforced concrete core wall is safer than other methods of waterproofing. If a core wall is adopted, a heavy slab over such a wall should be provided for protection.



Typical of the bridges recently built in Tarrant Co., Texas, 24 ft. wide.

Bridge Widths and Bridge Floor Materials

Data reported by 683 counties to the Editor of PUBLIC WORKS, showing standard practices in County Road Systems.

COUNTY highway officials have returned to *Public Works* 822 questionnaires covering various features of highway design, construction and maintenance. Of these, 683 answered one or more of the questions regarding bridge widths, bridge floor materials, culverts and subdrains, showing their practices on county road systems.

Standard Bridge Width and Bridge Floor Materials

Alabama—The bridges in Perry Co. and the old bridges in Dallas Co. are 16 ft. wide; new bridges in Dallas and all in Montgomery are 20 ft. In Tallapoosa Co. bridge widths are 18 ft.

Creosoted pine or untreated oak floors are standard in Perry Co.; wood floors in Tallapoosa; gravel (for surfacing) in Montgomery; clay or gravel on timber and concrete on steel or concrete bridges in Dallas.

Arizona—Apache Co. road system bridges are 16 and 20 ft.; Greenlee Co., 19 ft.; and Pinal Co. 24 ft.

Gravel surfacing is used on bridge floors in Pinal and asphalt and chips in Greenlee.

Arkansas—Seven counties report widths as follows: Chicot, 12 to 14 ft.; Desha, 2-car width; Ouachita 16 ft.; Sebastian and Montgomery, 24 ft.; Sharp, 28 ft.; and Sevier, 32 ft.

Three use oak or hardwood floors; 2 use concrete; and 2 use both concrete and wood.

California—Plumas and Siskiyou use 16 ft. width; Modoc, Nevada, Tehama, Sonoma and San Joaquin, 20 ft.; Imperial, 20-24 ft.; Los Angeles, 20 ft. or more; Stanislaus, 20 ft. clear roadway; Yola, old roads 20-ft., new roads, 26-ft.; Sutter, 16 to 26-ft.; Napa, 18 to 40 ft.; Imperial, 20 to 24-ft.; Kern, Fresno, Yuba and Tuolumne 24-ft.; Sacramento, 24 to 36-ft.; and Riverside, 26-ft.

Kern Co. used 2 x 4 laminated flooring; Riverside, Imperial, Fresno, Plumas, Los Angeles, Yuba, Stanislaus, Riverside, Sacramento, Sonoma, Tuolumne, San Joaquin, Yola and Sutter oil or asphalt, generally use wood for wooden or light steel bridges and concrete on concrete bridges.

Colorado—Ouray has no standard; Gunnison bridges are 10 ft. or more wide; Sedgwick and Washington, 20-ft.; Pueblo, 26 ft.

Four counties use wood floors and two use asphalt or oil mix surfacings.

Florida—Broward and Lee 18-ft.; Escambia, 20 ft.; Santa Rosa and Alachua, 20 to 24 ft.; Duval, 22 ft.; and Dade 24 ft.

Santa Rosa uses 2 x 4 timbers on edge for flooring. All others use timber floors, except Dade (concrete) and Escambia (concrete or wood).

Georgia—Mitchell and Murray, 16 ft.; Bryan and Clarke, 18-ft., (but Clarke considers 18 ft. too narrow); Walton, Meriwether and Oconee, 20-ft.; Randolph, 16 to 32 ft.

There seems to be no settled practice in floorings.

Idaho—Caribou, 16-ft. clear width; Power, 18 to 30 ft.; Canyon, Nez Perce and Franklin, 20 ft.; Minidoka, 20 to 24 ft.; Bannock, 20 to 30 ft.; Bonneville and Oneida, 24 ft.

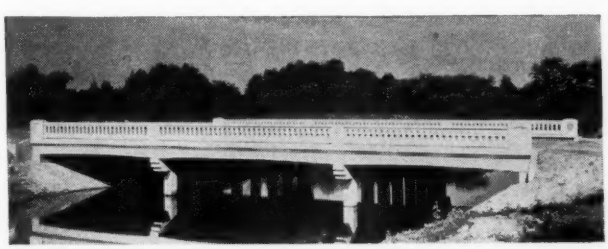
Canyon and Nez Perce use a laminated wood floor. Caribou uses 2" x 6" edgeways for flooring.

Illinois—Dewitt, 14 ft.; steel trusses in Logan, 14 ft.; Hamilton, 16 ft.; Stephenson, 16 ft. old and 22 ft. new; Fayette, 18 ft.; Iroquois, 18 to 30 ft.; Jackson, Jasper, Cumberland, Johnson, Cass and Kendall, 20 ft.; Carroll 22 ft. minimum; Montgomery, Knox, Madison, Macoupin and Stark, 22 ft.; Boone, Macon, Kane, Will, Kankakee, Marshall, Clark, Warren, Piatt, Ford, Menard, Crawford, Winnebago, Shelby and Monroe, 24 ft.; St. Clair, 20-22 ft.; McLean and Woodford, 24 to 30 ft.; Calhoun, 22 to 40 ft.; Morgan, 22 and 24 ft.; Tazewell, 20 to 30 ft.; Ogle, 30 ft.; Lake 30 to 40 ft.; and Du Page, 40 ft. Henderson has no standard.

Twenty-seven counties used concrete for flooring; one uses steel traffic plates on wood. Others are mainly oak or creosoted pine.

Indiana—Warrick, Henry and Sullivan, 14 ft.; Fountain, "2-lane"; DeKalb, 14 to 24 ft.; Madison (old), Scott, Putnam and Daviess, 16 ft. Hendricks, Union (not all are yet standard width), Gibson and Switzerland, 18 ft.; Johnson, Posey, Harrison (new), Miami, Spencer and Vigo, 20 ft.; Warren, 20 to 24 ft.; Grant, 18 to 24 ft.; Ripley, 22 ft.; Noble, Madison (new), Montgomery (new), Hamilton and St. Joseph 24 ft.

DeKalb and Sullivan use 2 x 4 upright for flooring. Fountain uses laminated pine. Eleven use concrete wholly or partly. The remainder use wood.



A reinforced concrete continuous slab on precast pile bents, with a 38 ft. roadway and two sidewalks in Mercer County, N. J.

Iowa—Madison, 14 to 18 ft.; Monroe, 14 to 22 ft.; Audubon, Pottawattamie and Taylor, 16 to 20 ft.; Palo Alto, 16 to 18 ft.; Winnebago, 16 to 24 ft.; Muscatine, 16 to 26 ft.; Howard, Guthrie, Lyon, Marion, Decatur, Clarke and Dickinson, 16 ft.; Winneshiek, Crawford and Mills, 16 ft. local and 20 ft. trunk; Pocahontas, 16 local, 24 trunk; Jones 18 and 24; Dallas, Kossuth, Boone, Lucas, Floyd, Page Union Lee, Van Buren, Harrison, Cerro Gardo (minimum) Chickasaw, Jasper, Mahaska, Calhoun, Louisa and Hamilton, 18 ft.; Carroll, Adams, Hardin, Emmett, Grundy, Shelby, Humboldt, Monona, Mitchell (minimum), O'Brien, Osceola, Keokuk, (new), Bremer and Fayette, 20 ft.; Polk, Jefferson and Dubuque, 18 to 20 ft.; Ringgold, 20 and 22 ft.; Story, 18 and 24 ft.; Clay, 22 ft.; and Johnson 24 ft.

An asphalt mat on wood or concrete is the standard surfacing in most counties. Hardin and Koekuk use laminated floors. Lee uses traffic plates.

Kansas—Jefferson, 14 ft.; Stevens, 16 ft.; Atchison, 16 to 27 ft.; Neosho, 14 to 20 ft.; Anderson, Sherman, Elk, Reno, Stanton, Decatur, Labette, Logan, Cheyenne, Chautauqua, Wallace, Greeley and Pottawattamie, 20 ft.; Woodson, 20 ft. for over 20-ft. span; Wabaunsee, Jewell, Mitchell and Franklin, 20 ft. minimum; Clark, Riley and Russell, 22 ft. or wider; Dickinson, Bourbon, Wilson, Kingman, Ottawa and Phillips, 20 to 24 ft.; Rawlins, Mitchell, Clay (over 10-ft. span), Cherokee, Morris, Crawford, Gove, Ellis, Brown (new), Sheridan, Allen, Geary, Rush, Leavenworth, Lincoln, McPherson, Meade, Linn, Stafford, Smith, Hamilton, Doniphan and Sedgwick, 24 ft.; Barton, 24 and 28 ft.; Thomas, Graham, Montgomery (min.), Wichita, Seward and Shawnee, 26 ft.; Finney, 20 to 28 ft.; Haskell, 26 to 30 ft.; Jackson, 24 to 28 ft.; Harper, Coffey, Cloud, Ford, Greenwood, Paenee, Douglas, Barber, Harvey and Osborne, 28 ft.; Gray, Comanche and Pratt 30 ft.

Concrete is used wholly or partly for flooring by 41 counties. Crawford uses steel traffic plates on wood; all others use timber with bituminous or occasionally gravel, surfacing in many cases.

Kentucky—Scott and Barron, 12 ft.; Fleming, 14 ft.; Nelson, Harrison and Jackson, 16 ft.; Boone, "2-way"; Kenton, Adair and Union, 20 ft.; Grayson 20 and 12 ft.; Mercer and Jefferson, 24 ft.

Use of timber and concrete for flooring is about equally divided.

Michigan—Iona, Schoolcraft and Grand Traverse, 16 ft.; Emmett, about 18 ft.; Monroe, 16 to 22 ft.; Missaukee, 16 to 24 (new bridges are 24-ft. minimum); Berrien, old 16 to 26 ft., new, 24 to 26 ft.; Luce, 19 ft.; Alpena, 16 to 26 ft.; Iosco, Presque Isle, Otsego and Chippewa, 20 ft.; Menominee, 22 ft.; Huron, Ottawa, Houghton, Oceana, Hillsdale, Livingston, Oakland, Lapeer, and Mason, 24 ft. or more; Ingham, 26 ft.; Shiawassee, 28 ft.; Keweenaw, Gladwin, Genesee, Dickinson, Leelanau and West Branch, 30 feet to 40 ft.

Concrete is most generally used for flooring, but wood is employed by a number of counties.

Minnesota—Bridge widths are as follows: 24 ft., Nobles, Winona, Waseca, Cass, Pennington, Wabasha, Washington, Murray, Scott, Nicollet, Watonawn, Stearns (more in some cases), Roseau, Olmsted, Goodhue, Fillmore (up to 27 ft.), Hubbard (new bridges); Steele, Renville, Clay, Chippewa (also 26 ft.), Mille Lacs, Lyon (minimum), Dodge, Blue Earth, Rock, Morrison, Jackson, Lincoln, Kittson, Itasca, McLeod, Sibley, Benton, Rice, St. Louis, Carver, Isanti, Houston, Wilkin, Crow Wing, Swift (minimum), Mower and Douglas, 44 in all, 20 ft.; Aitkin, Chisago, Martin (also to 24 ft.), Cook (also to 24 ft.) and Koochiching. Other widths are: Beltrami, 18 and 24 ft.; Faribault, 16 and 20 ft.; Wright, 16 ft., old and 26 ft. new; Carlton, 18 and 20 ft.; Grant, 16 to 24 ft.; Dakota, 22 ft.; Meeker, 18 to 26 ft.; Lac Qui Parle, 22 and 24 ft.; Mahnomen, 18 and 24 ft.; Hennepin, 28 ft.; Kanabec, 26 ft.; Red Lake, 40 ft.; Ramsey, 30 ft.; Cottonwood, 28 ft.

On concrete bridges, a concrete floor is almost universally used. On wooden bridges, the floors are of treated timber usually, and are often or generally paved with black top. Forty-one use concrete, wholly or in part; St. Louis Co. uses I-Beam Lock.

Mississippi—Coahoma, Lowndes and Forrest build a 20-ft. width bridge; Lauderdale, 18 and 20-ft.; and Lafayette, 12 and 16 ft.

Coahoma uses gravel ballast deck construction; Lowndes, concrete; Forrest, gravel and asphalt and Lauderdale creosoted wood and concrete.

Missouri—Widths, 12 to 16 ft., inclusive are reported by Polk, Reynolds, Adair, Osage, Monroe, Butler, Ray, Atchison and Stone. Widths of 20 ft. or more are reported by Cole (22 ft. clear), Ralls, Marion (new), Phelps, Pettis and Platte.

Wood floors, usually bituminous covered, predominate.

Montana—Widths of 16 ft. are reported by Big Horn (new bridges are 20 ft.), Treasure (16 and 18), Lincoln (16 to 20), Mineral and Broadwater; other widths are: Stillwater 26 ft. (new construction); Powell, 18 to 32 ft.; Valley, 20 ft.; Cascade, 24 ft.; Ravalli, 20 ft.; Missoula, 30 ft.; Richland 20 ft.; and Judith, 20 to 24 ft.

Wood floors, sometimes treated, are used almost exclusively. Valley county uses laminated plank.

Nebraska—Bridge widths of 20 ft. are reported by Brown, Hamilton, Clay, Platte, Richardson (also 22 ft.), Fillmore, Scotts Bluff, Hall, Dawson, Cass and Keyapaha, a total of eleven counties. 24-ft. widths are reported by Box Butte, Gage, Hayes, Phelps, Sheridan and Seward. Other widths are: Nance, 16 to 24 ft.; Thayer, 26 ft.; Lancaster, 22 to 24 ft.; Lincoln, 16 to 20 ft.; and Thurston, 16 ft.

With only a few exceptions floors are of wood, generally treated or covered with black top.

Nevada—Elka county reports 16-ft. wide bridges, with wood flooring.

New Jersey—Bridge widths: Mercer, 38 ft., plus 6 to 8 ft.; Middlesex, same width as right-of-way; Atlantic, Gloucester, Salem and Morris (more in some cases), 30 ft.; Sussex, 24 ft.; and Cape May 22.3 ft.

Cape May uses surface treated plank for floors; Middlesex, concrete, asphalt plank or wood; Atlantic, wood or asphalt block; and the others concrete.

New Mexico—San Miguel county bridges are 16 ft. wide and timber floors are used.

New York—Bridge widths of 20 ft. are reported by Cayuga, Putnam, Chautauqua (also up to 24 ft.), St. Lawrence (also to 24 ft.), Oneida and Warren (also to 28 ft.). Other widths are: Genesee, Chemung, Washington and Madison, 22 ft.; Ontario, Columbia, Fulton, Niagara, Oswego, Saratoga and Schenectady (also to 26 ft.), 24 ft.; Herkimer, 21 ft.; Tompkins, 28 ft.; Dutchess, 21 ft.; and Onondaga, 23 ft.

Concrete is almost universally employed for flooring.

North Dakota—Ramsey, Starr and Dickey counties report bridges with 20-ft. roadway width; Grand Forks, Traill, Mountrail, McLean and Williams, 24 ft.; Cass, 26 ft. Foster county states "most of our bridges are too old and too narrow."

Nearly all use wood floors.

Ohio—Widths of 20 ft. or over are reported by Summit (30 ft.), Ashland (24 and 26 ft.), Wood, Darke, Harrison, Cuyahoga (24 and 44 ft.), Franklin (26 and 28 ft.), Montgomery, Defiance, Lorain, Highland, Richland, Washington, Medina, Huron (26 ft.), Lake (24 to 30 ft.), Ottawa, Lucas (36 ft.), Auglaize, Fulton (new), and Muskingum. Widths of 20 to 22 ft. are reported by Clermont, Seneca, Jackson, Fairfield, Scioto (some are 24 ft.), Portage, Miami, Van Wert, Clinton and Wayne. Narrower bridges are reported by Sandusky (14 and 16 ft.), Morrow (16 ft.), Brown (16 to 18 ft.), Delaware (16 to 24 ft.), Coshocton (16 to 18 ft.), Geauga (14 to 24 ft.), Crawford (16 ft.), and Logan (16 ft.).

Wood floors are most generally used. Cuyahoga uses brick or Trilock. Concrete is used to some extent by 16 counties.

Oklahoma—Widths of 20 ft. are reported by the following counties: Atoka, Lincoln, Custer, Texas, Delaware, Kingfisher, Kay, Noble (new, old ones are 14 and 16 ft.), Murray and Ellis. Other widths are: Rogers, 24 ft.; Bryan, 22 ft.; Ottawa, 18 ft.; Muskogee, 16 ft.; Oklahoma, 20 to 40 ft., with 2 ft. to 5 ft. walks additional; Payne, 16 to 18 ft. for wood floors and 18 to 20 ft. for concrete floors; Cherokee, 24 ft.; Craig, 20 to 40 ft.; and Blaine 16 ft., minimum.

There appears to be no settled practice for bridge floors.

Oregon—Widths, 16 ft., Deschutes, Douglas (16 to 20 ft.) and Yamhill (16 to 18 ft.); 18 ft., Benton (18 to 20 ft.), Polk, Wallowa and Malheur; 20 ft., Linn (20 to 24 ft.), Clatsop, Lane (20 to 24 ft.), Josephine. Morrow, Union, Jackson and Washington (20 to 24 ft.); Klamath, 24 ft.; Multnomah, 24 ft.; and Clackamas, 24 ft.

Wood floors are almost universally used.

Pennsylvania—Widths of bridges, 22 ft., Northampton and Blair; 24 ft., Mifflin and Luzerne; 30 ft., Delaware; and 30 to 40 ft., Centre.

Two use Amiesite for floors, three concrete and two use treated or carpeted wood.

South Carolina—Bridge widths are: Greenville, 14 to 20 ft.; Orangeburg, 20 ft.; Darlington, 18 ft.; Oconee, no standard.

South Dakota—Bridge widths are: 24 ft., Brown, Douglas, Clark, Deuel, Lawrence, Union, Beadle, Charles Mix, Hutchinson and Clay. Other widths are: Hanson, 16 ft.; Perkins, 20 ft.; Moody, 28 ft.; Lyman, 18 ft.; Hughes, 20 ft.; Pennington, 20 to 24 ft.; Spink, 18 to 24 ft.; Jerauld, 16 to 24 ft.; Yankton, 26 ft.

Tennessee—Bridge widths: 14 ft., Washington; 12 to 20 ft., Warren; 16 ft., Giles; 16 to 20 ft., Shelby; 18 ft., Gibson; 20 ft., Jefferson, Dickson, Marshall and Lake; 24 ft., Davidson.

Texas—Bridge widths: 20 ft., Matagorda, Nueces, Karnes and Culberson; 22 ft. or over, Bee, new, 24 ft.; Coleman, 24 ft.; Eastland, 28 ft.; El Paso, 22 ft.; Jeff Davis, 24 ft. Others: McLennan, 16 ft., and Bexar, 18 ft.

Utah—Widths of bridges: Salt Lake, entire right-of-way; Beaver, 24 to 30 ft.; Iron. 24 ft.; Washington, 22 ft.; and Duchesne, 18 ft.

Virginia—Bridges in Arlington County are the width of the

right-of-way; in Henrico, bridges now being built are 24 ft.; Montgomery county bridges are 20 ft. wide; in Frederick, 20 to 30 ft.

Washington—Bridge widths, 24 ft. and over; San Juan, Benton and Adams; 20 to 24 ft.; Whatcom, Columbia (22 ft.), Kittitias, Grant (22 to 24 ft.), Snohomish (20 to 24 ft.), Garfield, Clallam (22 ft.), Jefferson, Ferry, Skamania, Pierce, Walla Walla (20, 24 and 30 ft), and Douglas; Lincoln, 18 to 24 ft.; Thurston, 18 to 24 ft.; and Pacific, 18 ft.

West Virginia—Bridge widths: Calhoun and Tyler, 16 ft.; Roane, 18 ft.; Mineral, secondary, 20 ft. and primary, 30 ft.; Upshur, secondary 14 ft. and primary 20 ft.; Ritchie, 30 ft.

Wisconsin—Bridge widths are reported as follows: 24 ft.: Sauk, Brown, Grant, Taylor, Oconto, Richland, Shawano (new), Douglas, Bayfield, Waupaca and Marathon; 26 ft.: Barron, Iowa, Vilas, Florence and Columbia; other widths: Waukesha, about 30 ft.; Vernon 20 ft.; Racine, small structures, 45 ft., large structures 30 ft.; Columbia, 26 ft.; Manitowoc, 28 ft; Dane, 30 ft.; and Dodge, 30 ft.

Wyoming—Sublette, 16 to 22 ft.; Campbell 16 ft.; Natrona, 18 ft.; Sheridan, 20 to 24 ft.; Laramie and Converse, 20 ft.; and Sweetwater, 23 ft.

Federal Aid for Defense Roads

The Federal Works Administrator on December 31st announced the apportionment among the states of $137,500,000 of Federal aid highway funds for the fiscal year beginning July 1, 1942. From these funds will be paid 75% of the cost of work on the strategic network of military highways, the state to pay the other 25%. Projects will be limited to those "having definite defense significance," including strengthening or replacement of weak bridges.

The apportionment among the states is shown in the following table, 2½% for administrative expenses having been deducted.

State	*Regular Federal Aid*	*Secondary or Feeder Roads*	*Grade Crossings*	*Total*
Alabama	$ 2,083,755	$ 364,657	$ 405,128	$ 2,853,540
Arizona	1,435,456	251,205	129,583	1,816,244
Arkansas	1,709,471	299,157	336,460	2,345,088
California	3,989,896	698,232	798,434	5,486,562
Colorado	1,793,222	313,814	255,449	2,362,485
Connecticut	620,283	108,549	164,002	892,834
Delaware	487,500	85,313	97,500	670,313
Florida	1,431,426	250,499	299,694	1,981,619
Georgia	2,517,196	440,509	495,487	3,453,192
Idaho	1,238,004	216,651	165,774	1,620,429
Illinois	3,947,786	690,863	1,012,936	5,651,585
Indiana	2,409,852	421,724	503,499	3,335,075
Iowa	2,494,254	436,494	538,416	3,469,164
Kansas	2,524,344	441,760	485,674	3,451,778
Kentucky	1,853,318	324,331	358,327	2,535,976
Louisiana	1,479,614	258,932	317,974	2,056,520
Maine	866,360	151,613	133,885	1,151,858
Maryland	832,207	145,636	197,436	1,175,279
Massachusetts	1,310,162	229,278	388,101	1,927,541
Michigan	3,028,945	530,065	651,739	4,210,749
Minnesota	2,702,831	472,995	526,346	3,702,172
Mississippi	1,780,492	311,586	314,073	2,406,151
Missouri	2,963,919	518,686	578,946	4,061,551
Montana	2,020,796	353,639	262,388	2,636,823
Nebraska	1,991,271	348,472	333,931	2,673,674
Nevada	1,275,386	223,193	97,500	1,596,079
New Hampshire	487,500	85,313	97,500	670,313
New Jersey	1,273,680	222,894	376,647	1,873,221
New Mexico	1,622,549	283,946	177,246	2,083,741
New York	4,821,071	843,688	1,330,156	6,994,915
North Carolina	2,387,356	417,787	514,993	3,320,136
North Dakota	1,499,001	262,325	299,447	2,060,773
Ohio	3,520,305	616,053	818,984	4,955,342
Oklahoma	2,272,612	397,707	442,035	3,112,354
Oregon	1,649,132	288,598	228,533	2,166,263
Pennsylvania	4,087,815	715,368	1,089,534	5,892,717
Rhode Island	487,500	85,313	97,500	670,313
South Carolina	1,346,362	235,613	298,209	1,880,184
South Dakota	1,577,778	276,111	253,551	2,107,440
Tennessee	2,112,542	369,695	382,507	2,864,744
Texas	6,313,862	1,104,926	1,098,295	8,517,083
Utah	1,123,730	196,653	129,761	1,450,144
Vermont	487,500	85,313	97,500	670,313
Virginia	1,844,177	322,731	374,250	2,541,158
Washington	1,585,782	277,512	303,889	2,167,183
West Virginia	1,096,603	191,905	264,466	1,552,974
Wisconsin	2,400,972	420,170	483,930	3,305,072
Wyoming	1,245,987	218,048	131,879	1,595,914
District of Columbia	487,500	85,313	97,500	670,313
Hawaii	487,500	85,313	97,500	670,313
Puerto Rico	493,438	86,352	165,506	745,296
Total	$97,500,000	$17,062,500	$19,500,000	$134,062,500

Toledo Dedicates a Fine New Waterworks

(Continued from page 15)

The 20 filters are arranged in four groups of five each, each having a capacity of 4 mgd at the rate of 2 gal. per sq. ft. per min., and each divided into two beds, 50 x 14 ft. Each half of each filter unit has its own rate controller, and each group of 5 filters has a master rate controller. The filters contain 30″ of sand on 18″ of gravel graded in four layers; the bottom layer ranging from 1″ to 1½″ in diameter and the top layer from ⅛″ to ¼″. Wheeler filter bottoms are used.

The filters are piped for both surface wash and underwash. For underwashing, filtered water is forced upward through the false bottom at any desired rate up to 36 inches rise per minute. Surface wash water is applied through a fixed pipe system suspended from the wash water troughs above the sand and is fed through 1½″ brass pipe caps, spaced 2 ft. 9 in. on centers and containing five ⅜-inch perforations. The underwash and surface-wash water is regulated through separate rate controllers. The main wash water piping, control valves, rate controllers and other appurtenances are located in the pipe gallery beneath the main operating gallery of the filter plant.

All operations are controlled from operating tables placed in the main gallery, one in front of each filter unit. These tables are made of black "Glastone," a masonry unit faced with Vitrolite structural glass—the first ever made of this material, which is used also for the walls of vestibules, stairways and lobbies of the three buildings.

Main gallery in the filtration plant, 360 ft. long. Ten filter control tables on each side.

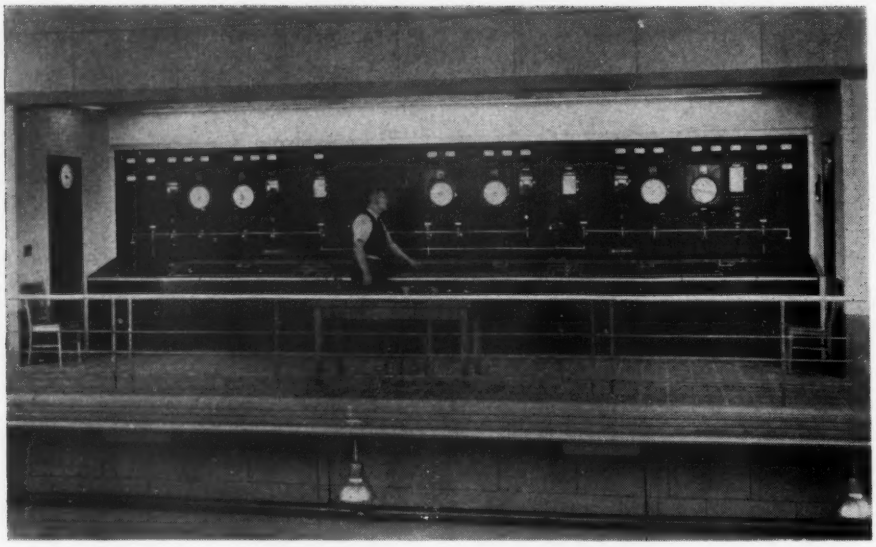
The filtered water is collected in concrete conduits beneath the filters and carried from the filter building to the reservoir about 500 ft. away through twin concrete conduits, each 4½ ft. by 4½ ft.

The filtered water reservoir is 660 x 396 ft. by 20 ft. deep, entirely underground. It is divided into two compartments, one of 2 mg serving as an inlet chamber, which overflows a weir into the 33 mg compartment. The former continues full while the water is being filtered as rapidly as pumped, and is connected to the high-service pumping station, thus taking full advantage of the total available head. When pumping exceeds filtration rate, a flap gate opens and admits water from the larger compartment into the smaller. The roof of the reservoir is covered with about 3 ft. of earth.

High Service Pumping Station

This contains three pump cells, each with space for two main pumping units. At present there are five

When you need special information—consult the *classified* READER'S SERVICE DEPT., pages 55-57



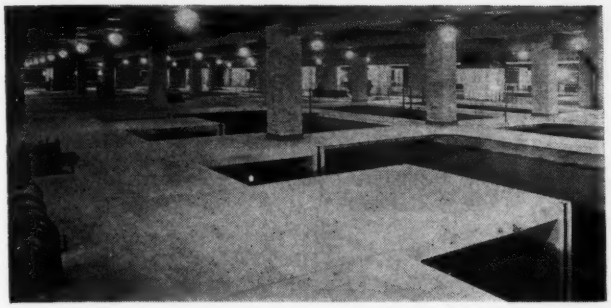
Westinghouse bench-type switchboard. The station piping system is represented on the bench by Lucite. When the attendant operates a control switch to close a valve, the plastic strip representing the associated pipe automatically becomes luminous. The operator can see at a glance the status of the entire pumping system. Individually lighted sections at the valve operating control switches also indicate whether the valve is opened, closed, or in process of opening or closing.

such units, four equipped with dual motors for two-speed operation and one with a single motor. Two of the two-speed have capacities of 55 mgd against 140 ft. head and 48.1 mgd against 107 ft. head at high and low speed, respectively; the other two have capacities of 65 mgd against 210 ft. and 57 mgd against 161 ft. The fifth pump has a capacity of 65 mgd against 210 ft. All motors are 6900-volt synchronous.

There is also a wash-water pump, capacity 5 mgd at 120 ft. head. Power is brought to the station from three separate sources, two by underground cable and one overhead. A Venturi meter measures and totalizes the discharge from each pump.

A 1,000,000 gal. elevated tank provides for emergency water storage; serves, in connection with surge relief mechanism, as a surge tank; and provides water for filter washing. It does not "float" on the distribution system but is kept practically full, at a pressure below that in the trunk main, by automatic valves, which connect it with the distribution system should a substantial drop in pressure occur. The tank is supported by ten steel columns resting on ten caissons 40″ to 50″ in diameter extending to bed rock 69 ft. below the surface. An eleventh caisson supports the 48″ inlet pipe.

From the pumping station a trunk main extends west across the city, intersecting the main arteries of the distribution system. It is 72″ diameter at the pumping station, reducing to 60″ and then to 42″ in a total length of 7 miles. This is shown on the general plan on page 15.



Reaction basins equipped with paddle mixers.

Cost of the Project

The total cost of construction of the project was $8,761,877. Cost of plant sites and pipe-line right of way, engineering, legal and administrative services and miscellaneous items bring the total to $9,884,463. The construction costs were as follows:

Soil test borings	$ 20,600
Intake crib and conduit	1,869,227
Lake pumping station	727,500
Lake Erie pipe line	1,124,900
Filter plant and reservoir	2,058,194
Chemical building	509,637
Main pumping station	831,170
Elevated tank	99,228
Trunk main	1,381,842
Improvements, existing works	128,500
Construction contingencies	11,079
Total construction costs	$8,761,877

All work on the project has been carried on under the direction of George N. Schoonmaker, chief waterworks engineer and now city manager; Robert W. Furman, commissioner of water, has been in close touch with the design of the filtration plant and the development of the project. William G. Clark acted as supervising construction engineer, and was in charge of the immediate supervision of construction of the entire project. Plans and specifications were prepared by Greeley & Hansen and they have maintained general advisory supervision of construction. L. G. Williams was resident representative for Greeley & Hansen throughout. S. Logan Kerr of Philadelphia has given special advice on surge suppression; Prof. William S. Housel of Ann Arbor was retained to advise on foundation conditions. Mills, Rhines, Bellman & Nordhoff of Toledo, were retained as consulting architects, working in cooperation with F. H. Schueman of Greeley & Hansen.

The equipment used was manufactured by the following firms:

Intake conduit concrete pipe—Lock Joint Pipe Co.

Low-service pumps in Low-Service Pumping Station—Worthington Pump & Machinery Corporation.

Motors in Low-Service Pumping Station—Westinghouse Electric & Manufacturing Company.

Pumps and motors in High-Service Pumping Station—Fairbanks, Morse & Co.

Mechanically operated screens—Chain Belt Company.

Stirring equipment—Link Belt Company.

Sludge collecting equipment—Link Belt Company.

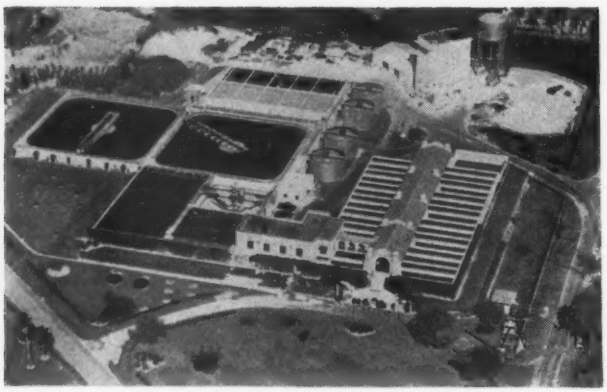
Dry feed machines—Jeffrey Manufacturing Company, with Toledo Scale Company scales for the weighing devices.

Rate controllers—Simplex Valve & Meter Company.

Operating tables—Pitt Construction Company.

"Glastone" for tables and walls, and the heat-absorbing window glass—Libby-Owens-Ford Glass Co.

Elevated Tank—Pittsburgh-Des Moines Steel Company.



Aerial view of the Miami, Fla., water purification plant.

The Waterworks Digest

Abstracts of the main features of all important articles dealing with waterworks and water purification that appeared in the previous month's periodicals.

Winter Marker For Hydrants

Augusta, Me., in winter attaches to fire hydrants in outlying sections a tall metal rod carrying a colored metal flag to indicate their location. The bottom of the rod ends in a coiled spring attached to a collar around the hydrant, which permits the rod to be swung away from the hydrant so firemen will have no difficulty in connecting their lines.[F106*]

Enameling Old Pipe

For coating old cast-iron pipe with coal-tar enamel, the pipes are removed and at once replaced with new or previously enameled pipe. The old pipe are cleaned by use of steel discs on long rods, using a series of discs of increasing diameters. Then, if badly pitted, hand scrapers are used (readily made from old automobile springs); otherwise, wire brushes, sometimes weighted. Then primer is brushed on, followed by enamel spun on.[A143*]

Work in A Reservoir in Service

A thousand feet of 36″ and 48″ steel mains were laid and 80 cu. yd. of concrete placed in the filtered water reservoir of the Delecarlia plant while the reservoir continued in service, a group of men working in the reservoir 24 hr. a day for almost a month. Samples of water from the reservoir every 4 hr. analyzed well within the U. S. Public Health Standards. All materials were sprayed with a hypochlorite solution before being lowered into the reservoir, the pipes both inside and out, all dirt first being removed by hand. Boats and rafts used in handling the pipe were kept clean and sprinkled daily or oftener with a 1% calcium hypochlorite solution, and were kept covered with the powdered material. All workmen wore rubber boots, cleaned with water and sprayed with hypochlorite solution, and stepped in a calcium hypochlorite foot bath just before entering the reservoir. One full-time inspector was held responsible for the disinfecting.[X57*]

Joint Water And Sewer Accounts

About 20 different forms of sewer service charges now exist, based upon uniform charges, the quantity of water consumed, the number and type of plumbing fixtures, the number of persons served, the type of premises, the character of the sewage, or upon a combination of two or more of these. A committee of the A.W.W.A. favors a charge based on metered water consumption, either as a percentage of the water bill or directly on a consumption basis. A flat rate is not fair to the small consumer. A rate based on fixtures is difficult to administer. Where a large percentage of the water used by an industry is not discharged into the sewer, some adjustment is proper. Water from private supplies reaching the sewer should be charged for; St. Paul and Minneapolis require meters on such supplies.

The committee favors putting sewer and water charges on the same bill for economy and simplicity; finds that, if carefully explained, this brings few complaints from consumers. For enforcing payment, the most logical and practicable method is to require payment of sewer charge with water bill, and shut off water if both are not paid. The water department should be reimbursed for all expenses incurred in collecting sewer accounts, such as additional billing equipment or cost of changing old equipment, new ledgers, and a fair share of postage, clerical and miscellaneous charges.

Detroit has found that, "after all the dire predictions of the difficulties that would result from billing and collecting sewage disposal charges, the entire Water Dept. personnel has been somewhat amazed to find how simple the operation turned out to be."[A152]

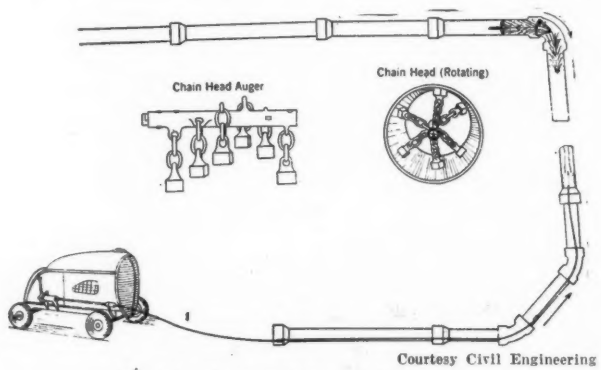
*See Bibliography in the December issue.

Liability For Damages

To create liability, damages must have been actually suffered by some person to whom the actor owes a duty of protection or assistance; and the actor must have done or failed to do some act which caused the damage, involving an unreasonable risk to others and falling short of the standard of good practice and of his duty. Damage from a leaking main imposes liability only when the operator has failed to use the care and skill recognized among operators as standard. An operator has a legal obligation to so use his facilities that water-borne disease bacteria will not reach consumers through any act or neglect of his.[X6]

Cleaning Large Water Mains In Place

Lines of 10″, 12″ and 20″ cast iron pipe badly clogged with deposits of calcium carbonate (20″ reduced to an 8″ opening) were cleaned as follows: A 5 ft. length of pipe was cut out electrically and a head tool on the end of a



Courtesy Civil Engineering

Revolving head tool for cleaning main.

flexible shaft inserted and revolved 800 rpm by a motor. The head tool is a steel bar 18″ long to which are fastened 6 chains, each having on its end a stellite lug the size of a 1″ nut. The rapid revolution kept the chains radial and the tool in the center of the pipe. Short chains were used first, followed by others, each set longer by an inch than its predecessor. As the flexible rod was pushed through, water flowing through in the opposite direction washed the broken deposits back to the working opening. 2,000 ft. of 10″ and 12″ pipe a day was cleaned at a cost of 14.5 cts. per foot for 10″ to $1.06 for 20″. L2

Hydraulics Of Filter Sand

Present day attention is centered on the following factors: Other things being equal, the length of filter runs between washings varies with the size of the sand grains (roughly as the 2.15 power of the effective size) and with porosity. There is a limit of size, and of porosity in relation to size, not to be exceeded for good filtration, but the limits are still uncertain. With good coagulation the size may be 1 m m and the porosity 55%, but with weak coagulation even 0.40 m m and 40% porosity may give poor results. The *shape* of sand grain affects sieve analysis—angular and elongated grains give sizes smaller than actual. Sand in filters is not so greatly stratified by filter washing as was formerly supposed. Considerable straining is effected to depths as great as 24″ or more. In a filter there is no one effective grain size that is controlling, but rather a range of grain sizes that influence the process. A157

Iron Removal in Western Pennsylvania

There are two basic methods of iron removal—oxidation and chemical treatment, each followed by filtration. When the iron is in the sulfate form, an alkali is required to convert it to insoluble hydrate. Small plants without skilled operators should be as simple and fool-proof as possible. Each method has its own advantages: Sodium zeolite completely removes ferrous iron and manganese in addition to softening. Coke tray aeration preceding birm filtration removed 60% CO_2, increased the pH to a minimum of 6.9, and increased dissolved oxygen from zero to 8.0 ppm. Iron was reduced at rates of from 1.25 to 4 gpm per sq. ft., but no manganese was removed. Manganese zeolite satisfactorily removed iron and manganese in water containing 2 ppm or less of both combined. Coke contact aeration and sand filtration are satisfactorily handling water with medium to high iron content at filter rates of 1 to 1.5 gpm per sq. ft. The lime treatment, sedimentation and filtration installations give practically complete removal of iron and manganese. The aeration, lime or lime-soda softening installations remove iron and manganese completely, and all CO_2 is removed or neutralized. A153

Twilight Zone in Threshold Odor Determination

This paper purposes to show that "the human sense of smell is totally unreliable as a means of estimating odor concentrations quantitatively with any acceptable degree of accuracy." Others contended that, even should different observers, or the same observer at different times, make threshold decisions that vary as much as 100% (about 75% was claimed), this variation is less than the average critical consumer will notice. Also the threshold test is not a differential one, but a determination of the faintest odor that can be detected. There was general agreement, however, that there is a "twilight zone"—a region "bounded at one end by that dilution at which an indefinite number of observations will all be rendered positive, but immediately above which will be a dilution for which at least one observation will be negative"; while at the other end is a dilution giving 3 negatives in 3 trials while immediately below is a dilution giving at least one positive observation. A154

Bibliography of Waterworks Literature

The articles in each magazine are numbered continuously throughout the year, beginning with our January issue.

c. Indicates construction article; *n,* note or short article; *p,* paper before a society (complete or abstract); *t,* technical article.

A *Journal, American Water Works Ass'n.*
November

1. Water Supply Facilities and National Defense. By J. E. Hoover. Pp. 1861-1865.
2. Notes on Water Works Defense. By D. S. Thomas and H. B. Foote. Pp. 1866-1868.
3. National Defense Council at Gloversville, N. Y. By R. M. Colt. Pp. 1869-1874.
4. Regional Water supplies. By A. Wolman. Pp. 1875-1896.
5. Management Problems of a Municipal Utility District. By J. S. Longwell. Pp. 1897-1910.
6. Joint Administration and Collection of Water and Sewer Accounts. Committee Report. Pp. 1911-1928.
7. Iron Removal in Western Pennsylvania. By L. S. Morgan and C. H. Young. Pp. 1929-1944.
8. Studies on the Accuracy of Threshold Odor Values. By R. Hulbert and D. Feben. Pp. 1945-1964.
9. Methods of Determining Fluorides. Committee Report. Pp. 1965-2017.
10. Modification of the Fluoride Determination. By R. D. Scott. Pp. 2018-2020.
11. Specifications for Filtering Materials. Committee Report. Pp. 2021-2034.
12. Ozonation at Whiting, Ind. By J. F. Bartuska. Pp. 2035-2050.
13. Methods of Water Treatment and Laboratory Control. Committee Report. Pp. 2051-2060.

E *Engineering News-Record*
December 4

1. *c.* Lining the World's Longest Tunnel (Delaware Aqueduct). Pp. 70-75.

F *Water Works Engineering*
December 3

1. Competent Plant Operation. By J. B. Harrington. Pp. 1494-1496.

December 17

2. Automatic Station Control. By G. C. Boyer. Pp. 1556-1557.
3. Acid Treatment for Wells. Pp. 1560, 1570.
4. All-Time Record Low Runoff Menaces New York City Supply. P. 1567.

G *Water Works & Sewerage*
November

1. Some Water Treatment Experiences at Sanford, Me. By H. L. Clark. Pp. 500-502.
2. *p.* Joint Administration and Collection of Water and Sewer Accounts. By L. N. Thompson. Pp. 530-535.
3. Streamlining the Meter Test. By D. R. Taylor. Pp. 536-537.

J *American City*
December

1. Oklahoma City Water Supply Being Improved. By H. Thompson. Pp. 60-61, 79.
2. Remodeling Turlock, Calif., Water Supply. By F. K. Balch. Pp. 69, 71.
3. Multiple-Floor Plant of Yankton, S. D., Water Works. Pp. 73, 75,

L *Civil Engineering*
December

1. Use of Ozone for Water Purification. By A. W. Consoer. Pp. 701-702.
2. Cleaning a Large-Size Pipe Line in Place. By W. H. Mead. Pp. 728-730.

M *Water and Sewage*
November

1. Is Your Distribution System Ready for Wartime Emergencies? By C. Inglee. Pp. 16-18, 44-47.
2. *p.* Emergency Chlorination Equipment. By H. A. Faber. Pp. 21-22, 42.

December

3. Improvements to Scarborough, Ont., Waterworks System. By R. Harrison. Pp. 11-15.
4. *c.* Constructing 236 miles of 12 Inch Steel Pipe in Maine-Quebec. Pp. 16-17, 44.
5. Maximum Number of Cross Connections for Defense. Pp. 19, 41.

P *Public Works*
December

1. Installing and Operating a Settling Basin Baffle System. By H. M. Frye. Pp. 16-18.
2. *n.* Disposal of Filter Wash Water. P. 18.
3. Streamlining a Pipe Shop. By A. K. Akers. Pp. 21-23.
4. Soil Conservation Helps to Protect Water Supply. By A. Reichstein. Pp. 33-35.
5. Priorities for Water Works and How to Get Them. Pp. 38-39.

X *Pennsylvania Water Works Operators Ass'n.*
Year of 1941

1. Experiments on the Effect of Cathodic Treatment on the Quality of Water. By P. S. Armstrong. Pp. 57-67.
2. Effect of Silting on Storage Reservoirs and Preventive Measures. By C. B. Brown, Pp. 68-84.
3. Effect of Internal Pipe Lining on Water Quality. By P. Weir. Pp. 85-105.
4. A Talk on Maintenance. By F. W. Jones. Pp. 106-110.
5. Allowable Rates of Filtration. By M. C. Smith. Pp. 111-121.
6. The Legal Responsibilities of the Water Works Operator. By J. H. Murdock, Jr. Pp. 122-132.
7. Merits and Demerits of the Licensing of Water Works Operators. By H. E. Jordan. Pp. 133-138.

Boletim da Reparticao de Aguas e Esgotos (Brazil)
September

8. Torre d'Agua de Sant Anna. By J. M. T. Malta and A. L. Ippolito. Pp. 120-183.

Defense Savings Pay-Roll Allotment Plan

How company heads can help their country, their employees, and themselves

voluntary pay-roll allotment plan | helps workers provide for the future | helps build future buying power | helps defend America today

This is no charity plea. It is a sound business proposition that vitally concerns the present and future welfare of your company, your employees, and yourself.

During the post-war period of readjustment, you may be faced with the unpleasant necessity of turning employees out into a confused and cheerless world. But you, as an employer, can do something *now* to help shape the destinies of your people. Scores of business heads have adopted the Voluntary Pay-roll Allotment Plan as a simple and easy way for every worker in the land to start a *systematic* and *continuous* Defense Bond savings program.

Many benefits . . . present and future. It is more than a sensible step toward reducing the ranks of the post-war needy. It will help spread financial participation in National Defense among all of America's wage earners.

The widespread use of this plan will materially retard inflation. It will "store" part of our pyramiding national income that would otherwise be spent as fast as it's earned, increasing the demand for our diminishing supply of consumer goods.

And don't overlook the immediate benefit . . . money for defense materials, quickly, continuously, *willingly*.

Let's do it the American way! America's talent for working out emergency problems, democratically, is being tested today. As always, we will work it out, without pressure or coercion . . . in that old American way; each businessman strengthening his *own* house; not waiting for his neighbor to do it. That custom has, throughout history, enabled America to get things done *of its own free will*.

In emergencies, America doesn't do things "hit-or-miss." We would get there *eventually* if we just left it to everybody's whim to buy Defense Bonds when they thought of it. But we're a nation of businessmen who understand that the way to get a thing done is to *systematize* the operation. That is why so many employers are getting back of this Voluntary Savings Plan.

Like most efficient systems, it is amazingly simple. All you have to do is offer your employees the convenience of having a fixed sum allotted, from each pay envelope, to the purchase of Defense Bonds. The employer holds these funds in a separate bank account, and delivers a Bond to the employee each time his allotments accumulate to a sufficient amount.

Each employee who chooses to start this savings plan decides for himself the denomination of the Bonds to be purchased and the amount to be allotted from his wages each pay day.

How big does a company have to be? From three employees on up. Size has nothing to do with it. It works equally well in stores, schools, publishing houses, factories, or banks. This whole idea of pay-roll allotment has been evolved by businessmen in cooperation with the Treasury Department. Each organization adopts its own simple, efficient application of the idea in accordance with the needs of its own set-up

No chore at all. The system is so simple that A. T. & T. uses exactly the same easy card system that is being used by hundreds of companies having fewer than 25 employees! It is simple enough to be handled by a check-mark on a card each pay day.

Plenty of help available. Although this is *your* plan when you put it into effect, the Treasury Department is ready and willing to give you all kinds of help. Local civilian committees in 48 States are set up to have experienced men work with you just as much as you want them to, and no more.

Truly, about all *you* have to do is to indicate your willingness to get your organization started. We will supply most of the necessary material, and no end of help.

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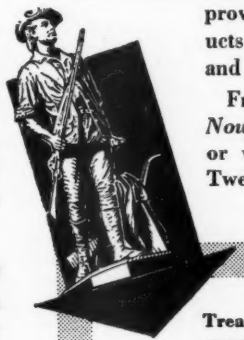

France left it to "hit-or-miss" . . . and *missed*. *Now* is the time for *you* to act! Mail the coupon or write Treasury Department, Section A, 709 Twelfth St. NW., Washington, D. C.

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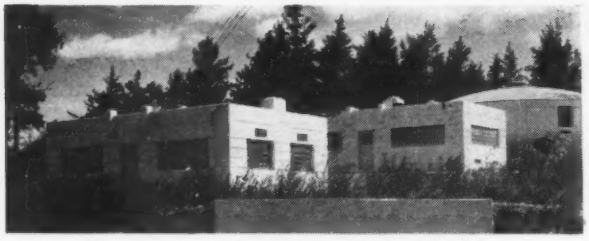


Sewage treatment plant at Bagley, Minnesota.

The Sewerage Digest

Abstracts of the main features of all important articles dealing with sewerage and sewage treatment that appeared in the previous month's periodicals.

Determining Dissolved Oxygen by Dropping Mercury Electrode

The Winkler method of dissolved oxygen determination is accurate but neither rapid nor continuous. Using the dropping mercury electrode method and a galvanometer with an indicating scale, an operator can perform other duties and watch the dissolved oxygen concentration by merely glancing at the scale. Recording instruments would be desirable at larger plants. Calibration of the equipment shows that it is suited for indicating continuously the dissolved oxygen concentration in activated sludge aeration tanks or in streams. [C1]

Proteins Aid Chemical Treatment

Small dosages of proteins such as gelatin produce heavy ball-like floc when sewage is treated with ferric chloride, as little as 2 ppm not only changing the character of the floc but reducing the amount of ferric chloride necessary. Doses up to 10 ppm were more effective, but over 40 ppm was detrimental. As low as 4 ppm reduced amount of coagulant necessary for clarification by 25 to 50% and caused formation of a ball-like floc that would settle despite agitation at flocculation speed. Gelatin (grade immaterial) was the protein giving the best results. A compound of gelatin and ferric chloride facilitated feeding and had excellent coagulating ability. Similar compounds containing divalent metallic ions were not so effective for coagulation as those using trivalent. Ferric chloride-gelatin compounds gave effluents as good as or better than ferric chloride in terms of B.O.D., oxygen consumed, total bacteria and *E. coli*. Gelatin-ferric chloride compounds gave good results in dewatering ripe sludge without the addition of conditioning chemicals, but were not superior to ferric chloride alone for dewatering fresh solids. Pretreatment of sewage with carbon dioxide prior to addition of ferric chloride-gelatin coagulant reduced the dosage required for complete clarification. Return sludge did not aid this process. Flash mixing reduced the size of the floc particles. [C2]

Fort Wayne Treatment Plant Details

Fort Wayne, Ind., in November 1940 completed an activated sludge-digestion plant for an average dry-weather flow of 17 mgd, costing $5,160,000. The two mechanically cleaned bar screens, 4 ft. wide, ¾" clear space between bars, are unusually heavy. Each screen rake is driven by a 1 hp motor, supplying a pull of not less than 1,000 lb. per ft. width of rake, and the screens were made strong enough to stall the motors when the rakes are tied to them. Screened sewage is pumped by 4 vertical pumps with slip-ring motors, which give each pump three capacities—6,000, 7,500 and 9,000 gpm; the number and speed of the pumps in operation at one time being controlled by a float switch with a 10-point controller. These pumps have wire-to-water efficiency of 78% at 9,000 and 6,000 gpm.

Return sludge is pumped by air lift, with efficiency between 18 and 20%. As the total lift is only 1.2 to 2.0 ft., this low efficiency is more than offset by low first cost, small space required, no spare unit needed, no check or gate valves, simple piping with low head loss, almost complete absence of maintenance and repairs, and above all extreme flexibility of control. [H2]

Research In Biofiltration

The Sanitary Engineering Research Laboratory of New York University has installed an experimental biofiltration plant with a nominal capacity of 15,000 gpd, using domestic sewage from the city's sewers. The filters are 7 ft. in diameter and stone 3 ft. deep. Floating-cover digesters will treat the biofiltration sludge at both mesophilic and thermophilic temperatures. Information will be sought to serve as a basis of design, the principal factors of which are organic load on the filter, recirculation ratio, detention time and overflow rate in settling tank, depth of filter, ventilation and underdrainage, dosing rate and method of distribution, and number of filters in series. [H1]

Factors Influencing Vacuum Filtration

In discussing this paper (See X 45 in the December "Digest") L. W. Van Kleeck said that over-conditioning of sludge may be worst thing an operator can do. Mechanical stirring is better than use of compressed air. Sludge can be too thick, and coagulated sludge too coarse. Filter vat agitators may be worse than useless, scouring conditioned sludge from the drum. The major objectives should be improvements made by designing vacuum filters and appurtenances especially for handling sludge, rather than continuing struggles with machines developed primarily for industrial purposes; to maintain a clearing house for practical helps; and to foster and engage in research on sludge conditioning, coagulants, filter cloths and other factors. [C5]

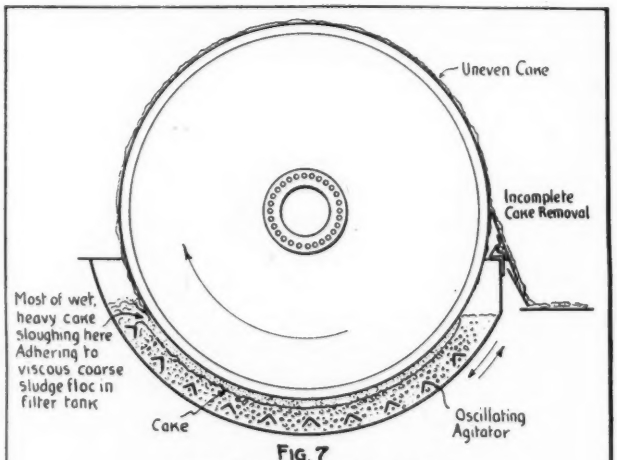
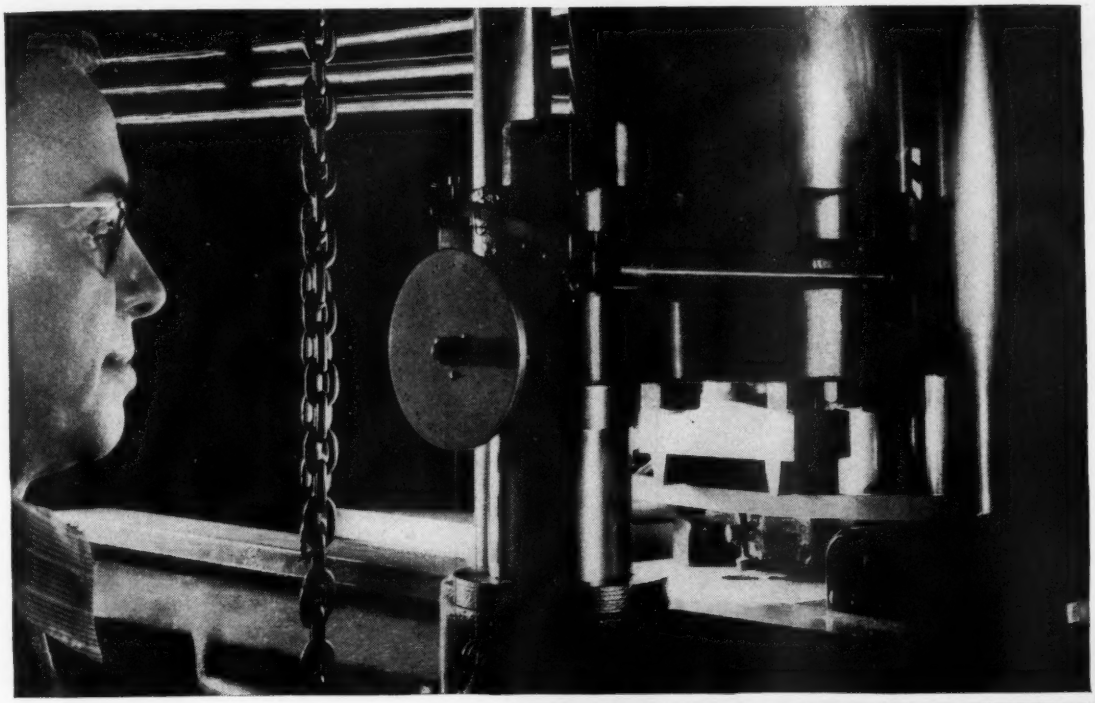


FIG. 7
When Floc is too Good for Filter

Courtesy Sewage Works Journal

If the floc is coarse and easy to drain and the drum is submerged in too much sludge, a very thick deposit of this mush will accumulate on the drum, and gravity and the viscous drag of the thick sludge will often drag part of the thickened cake from the drum.



* The "Talbot Strip Test," illustrated above, is an acceptance test for cast iron pipe. The modulus of rupture and secant modulus of elasticity are determined from this test, made on a strip cut from the wall of a pipe. It is one of the routine tests made by this Company to insure that the quality of its pipe meets or exceeds the requirements of accepted standard specifications for cast iron pipe. *United States Pipe and Foundry Co., General Offices: Burlington, New Jersey.* Sales Offices in Principal Cities.

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Disinfecting Sewage By Chlorination

Conclusions from 31 months' operation of the sewage treatment plant at Buffalo, N. Y., including 11,000 bacteriological analyses, are given. In regular operation, after 2 or 3 min. aeration of the sewage, chlorine is added to it 1 or 2 min. before it enters the sedimentation tanks. Residual is maintained at 0.1 ppm 15 min. after adding the chlorine. Conclusions: (1) Bacterial analysis of refrigerated composite samples gives erroneous results. Chlorinated samples should be treated with thiosulfate. (2) By considering the hourly variations in chlorine demand, it is possible to choose 5 or 6 hours during the day for which the average data will approximate the average for the entire 24 hrs. and thus give a relatively accurate picture of the day's disinfection results. (3) The bacterial population and coliform content of raw sewage vary as the temperature of the sewage and directly as its strength. (4) Maintenance of 0.1 ppm residual chlorine at 15 min. with the total contact time of 30 to 45 min. reduces the coliform content to about 1,000 per ml. for a kill of 98.6%, regardless of the temperature of the sewage, and produces 98.6% kill of total bacteria. Total bacteria are about 11 times the coliform in raw sewage and 16 times in chlorinated effluent. (5) Little additional kill is gained by increasing residual above 0.1 ppm. (6) Storm flows have little effect on the concentration of bacteria in raw sewage; but the effluent content then is more than twice as great because storm flow is only partly chlorinated. (7) Maintenance of 0.1 ppm residual with hourly adjustment of dosage gives a reduction of bacteria to approximately 1,000 per ml. (except during storms), regardless of temperature, chlorine demand, original bacterial content and strength of sewage. (8) Since inception of this treatment the coliform content of the Niagara river has been reduced by approximately 98%. C4

Sludge Gas For Water Fuel

The 42 mgd Clayton sewage plant at Atlanta, Ga., furnishes sufficient gas to operate the plant and an excess of 160,000 cu. ft. daily. This excess could be used for power at the city's pumping station with an investment of $4,400, substituting for $7,000 worth of coal a year. Or it could be used for motor fuel, for operating the city's 60 garbage trucks, the purifying and compressing equipment costing $34,520, with annual fixed charges and operating cost of $15,743, replacing gasoline costing $19,350, and thus saving $3,600. But this would use only half the gas; if all were used the saving would be about $8,000. This requires compressing the gas to 150 psi, cooling, washing out the CO_2, compressing to 3200 lb., and charging into cylinders 9" diameter and 5 ft. long. About 20% of the gas would be consumed in the engines operating the compressors. E1

Control of Chlorine Dosage

At Buffalo, N. Y., adjusting chlorine dosage to changes in sewage quality is performed manually, based on hourly analyses. Each hour 5-pint samples of raw sewage are collected at the inlet well, of clarifier influent (1 min. after chlorination) and of plant effluent (within 10 min. of raw sewage samples), and all analyzed at once. If the chlorinated clarifier influent and effluent show no chlorine residual, the chlorine demand of all three samples is determined about 15 min. after collection. On the basis of all these tests the dosage for the next period is calculated. This will be about an hour after the samples were taken, and to allow for changes in the meantime a table has been prepared based on past experience, giving the average chlorine demand for each hour of the day, for each of six seasons of the year based on temperature. This table gives, for each hour, the percentage by which the chlorine demand of the previous hour must be multiplied to obtain the demand for the hour desired. These factors range between 0.9 and 1.2. The dose is based on the calculated

demand and the rate of flow. Variations may be necessary due to special conditions, such as storms, pumping schedules etc. and special rules for these have been developed. [G2]

Winter In Activated Sludge Plants

When temperatures are low, piston compressors, which heat the air, have advantages over blowers. Condensation and freezing in the air lines may give trouble. Submergence of air lines and valves in the sewage prevents this; shielding from direct wind action helps; needle-point valves freeze easily if moisture is present. Clarifier drive mechanism operating on a track may be subject to attacks by sleet, which sand on the track may overcome. Winter drying of sludge on open beds is impracticable in most parts of Canada; covering the beds, heating, winter storage, and removal of frozen sludge have been solutions employed. In some cases covered beds have been heated by unit heaters which blow hot air against the sludge, creating currents; the drying period still being about twice as great as in summer. [M2]

Bibliography of Sewerage Literature

The articles in each magazine are numbered continuously throughout the year, beginning with our January issue.

c. Indicates construction article; *n*, note or short article; *p*, paper before a society (complete or abstract); *t*, technical article.

C *Sewage Works Journal*
November

1. *t.* Determination of Dissolved Oxygen by the Dropping Mercury Electrode. By R. S. Ingols. Pp. 1097-1109.
2. *t.* Protein as an Aid to Chemical Treatment. By H. W. Gehm. Pp. 1110-1130.
3. Operation of Sewerage Systems and Sewage Treatment Works From the Standpoint of National Defense. By W. J. Scott. Pp. 1131-1148.
4. Disinfection of Sewage by Chlorination (at Buffalo, N. Y). By G. E. Symons and R. W. Simpson. Pp. 1149-1163.
5. Principles and Factors Influencing Vacuum Filtration of Sludge. By A. L. Genter. Pp. 1164-1208.
6. *t.* Natural Purification of River Muds and Pollutional Sediments. By G. M. Fair, E. W. Moore and H. A. Thomas, Jr. Pp. 1209-1229.
7. Experiences in Odor Control. By C. C. Agar, G. W. Moore, M. M. Cohn, C. W. Gillespie, V. E. Haemmerlein, F. Hall, F. Klinck, G. E. Pinkney, E. J. Smith, E. A. Sterns. Pp. 1230-1240.
8. Extracts From Operation Reports. (Mansfield, O., Aurora, Ill., Worcester, Mass.) Pp. 1241-1247.
9. Bottle Experiments as Guides in Operation of Digesters Receiving Copper-Sludge Mixtures. By H. T. Rudgal. Pp. 1248-1250.

E *Engineering News-Record*
December 4

1. Sludge Gas for Motor Fuel. Pp. 80-81.

G *Water Works & Sewerage*
November

1. Recirculating High-Rate Filter in Industrial Waste Treatment. By E. F. Eldridge. Pp. 483-490.
2. Dosage Control in Sewage Chlorination. By J. W. Johnson. Pp. 519-524.
3. *p.* Sludge Pumping. By S. E. Kappe. Pp. 525-529.

H *Sewage Works Engineering*
November

1. Biofiltration Research in N. Y. U. Pilot Plant. By R. Eliassen. Pp. 590-591, 597.
2. Digestion Factors at Fort Wayne Activated Sludge Plant. By C. W. Cole and R. J. Bushee. Pp. 592-597.

J *American City*
December

1. New Sewerage System and Primary Treatment for Duluth. Pp. 51-53, 81.

M *Water and Sewage*
November

1. Chlorination of Sewage Effluents. By W. W. Watmough. Pp. 11-12, 38-39.
2. *p.* Cold-Weather Operation of Sewerage Systems. By A. E. Berry. Pp. 13-15, 40-41.

December

3. Sewage Sludge as a Soil Conditioner. By L. R. Sowerby. Pp. 20, 38.

P *Public Works*
December

1. The First Year of Operation of the Liberty Biofilter Plant. By J. Lawrence and H. Eichenauer. Pp. 14-15, 41.
2. What Do You Know About Sanitary and Public Health Engineering? Pp. 36-37, 42.
3. Flow Measurement of Sewage and Sludge. By C. G. Richardson. Pp. 40-41.

X *Boletim da Reparticao de Aguas e Esgotos (Brazil)*

1. Operacao de Estacoes de Tratamento de Esgotos. By B. Borges. Pp. 95-108.

Third Year of Treatment at Buffalo

(Continued from page 28)

Following the establishment of complete routine activities, it has been possible to extend the studies on special and research problems concerned with sewage treatment and solids disposal. Some of these studies reached a conclusion during the year, others are still being investigated.

Operating Results

Daily data and monthly averages and totals on plant operation and laboratory results have been compiled and summarized in Table I. Several of these results have been plotted as monthly averages in Plates I and II. (Table I and Plates I and II will appear in the next installment.) Although precipitation was 8.74 inches below normal, the average daily pumpage (140 m.g.d.) was higher than previous years, and was equivalent to a total of 51,262,500,000 gal. This high average was due principally to unseasonal high flows in November and December. The maximum pumping rate (447 m.g.d.) was only slightly higher than the previous year, but high daily flows exceeded last year's maximum (316 m.g.d.) on six occasions and reached a record high of 348 m.g.d. Dry weather flows averaged 115 m.g.d.

Solids Removal: The total removal of solid matter in the plant (18,340 tons) increased over the previous year, even though the amount of grit removed (2041 tons) and the efficiency of settleable solids removal in the clarifiers decreased. The decrease in grit removal probably resulted from the completion of sewer cleaning activities on old deposits, and the decrease in efficiency of clarifiers from the increased average flow.

Suspended solids in the effluent (110 p.p.m.) showed slight improvement in spite of the higher pumpage, and for dry weather flows averaged approximately 90 p.p.m. Once again it appeared that the suspended solids data on the raw sewage were low. By using the following data; (1) raw solids loading on the digestors (as calculated from sludge burned plus gas produced); (2) the grit removed, and (3) the effluent analysis, it is possible to calculate the raw suspended solids. This calculated value (195 p.p.m.) is equivalent to a per capita load of 0.38 lb. per day. This is practically the same as the similarly calculated value for 1939-40 (0.37 lb. per cap. per day) and appears to be approximately normal for Buffalo sewage.

Disinfection: During the latter half of the year, the chlorine demand (in pounds) of the raw sewage was practically constant at a value 28 per cent higher than in 1939-40. This increase is believed to have been due to increased industrial activity. With the higher demand, the average dosage (6610 lb./day) increased 18.4 per cent, and the total chlorine used was 1,206.4 tons. Following the completion of 2½ years of laboratory study on dosage control, it was possible to improve control, resulting in a saving in the amount of applied chlorine.

Somewhat less than complete satisfaction of the chlorine demand was maintained, with the result that the chlorine demand of the effluent was less than 1000 lb. per day. On the average, this chlorine dosage resulted in reducing the coliform bacteria content in the effluent to 915 per milliliter, (dry weather average was less than 500 per ml.) for an average kill of greater than 98.4 per cent.

(To be continued in February)

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Keeping Up With New Equipment

A New Austin-Western Twin Unit Crushing Plant

The Austin-Western Road Machinery Company, Aurora, Ill.

This company has recently placed on the market a highly portable double unit crushing plant capable of delivering exceptionally large outputs of crushed gravel or stone. It is suited equally well for gravel or for quarry service and consists of a 4022 all roller bearing roll crusher, 4′ x 12′ triple deck gyrating screen and rotary return elevator, all mounted on a six-wheel, pneumatic tired truck equipped with 30″ feed and delivery conveyors. The primary unit which is used ahead of the secondary unit for gravel service normally consists of a 1036 jaw crusher with scalping screen mounted on a truck with a feed conveyor; for quarry service a large opening jaw crusher with apron type feeder is used.

A-W Portable Double Unit Crushing Plant.

The moving weight of the secondary plant has been held to 39,000 pounds with an overall width of 8′ and overall height when operating of 13′. Height can be readily reduced to 12′ to provide additional transporting clearance. Similarly, the weight of the primary unit for gravel service is but 23,000 pounds with an overall width of 8′ and height of 11′.

The use of two units provides a most flexible arrangement, capable of meeting the various material specifications from local deposits; it also permits all parts to be readily accessible. The combination of low moving weight with easy portability and high output will appeal especially to the operator of this type of equipment.

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28 days before Pearl Harbor this firm forehandedly announced emergency chemical feeders for war emergencies. The line includes "equipment ranging from stock items such as small chemical feeders up to large complete water purification and pumping units (Pur-O-Pumpers) or up to automobile drawn trailer type 'Blitz Buggies', tailor-made and built to order for meeting the dozens of crises which a waterworks may have to meet in a future possibly complicated by sabotage, bombing and other by-products of war."

Literature is available on request.

Squeegee Type Pump

Huber Pump Division
Downingtown Mfg. Co., Downingtown, Pa.

This consists of a Flexible Rubber Tube which is alternately squeezed and released in a rocking, squeegee manner so that the liquid or gas is actually breathed into and out of the tube. The liquid or gas being pumped is totally enclosed within the tube, from the time it enters the pump until it leaves, thus it cannot come in contact with any metal part of the pump. The tube itself can be made of pure gum rubber and various acid and oil resisting synthetic materials; in addition, rubber tubes can be lined with synthetic materials for corrosion resistance or to prevent contamination. Cleaning or sterilization is easy and does not require taking the pump apart. . . . Solutions containing solids, whether abrasive or otherwise, cause practically no wear, since the inside of the tube is a smooth, continuous surface, with no projections, corners, crevices, or similar vulnerable places. High percentage of solids, high specific gravity of solids or solutions and viscous or stringy solutions are safely handled, for whatever can be drawn into the pump can be pumped out. No churning or agitation is caused by the pumping action. Likewise, hot or cold liquids or gases do not affect the operation of the pump or the life of the tube. The pump is noiseless in operation, due to the cushioning action of the tube between moving and stationary parts of the pump. Capacities range from ½ gallon per minute up to 50 gallons.

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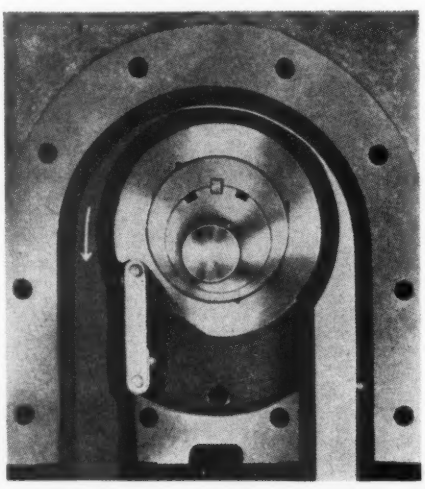

Huber Squeegee Type Pump.

Chevrolet Truck On Test Climb.

Chevrolet Booster Tests

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Sewer Cleaning Equipment

Champion Corporation
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A 20-page catalog describing and illustrating a full line of equipment for cleaning all sizes of sewers and a 6-page folder on the O.K. Champion Power Sewer Cleaner, are available. Copies of both will be sent on request.

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The new Model 205WM MOBILCRANE is another step in completing the Osgood lines of one-man, one-motor operated, pneumatic tired wheel mounted cranes.

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The main truck chasis is made up of I-beams and diaphragms, with welded joints. This gives a sturdy base for the upper body. The rear axle is solid steel

with turned ends for the dual wheels. Wheels are cast steel, and have one-piece brake drum and driving sprocket. All wheels are roller bearing mounted. The front axle is pivoted in the center to provide a three point suspension for the frame. Differential is bevel gear type, carried in ball bearings, and operates in oil bath. Screw jacks are provided on the rear bumper plate to relieve the tires of excessive loads when making heavy lifts. Outriggers are provided for working over the side.

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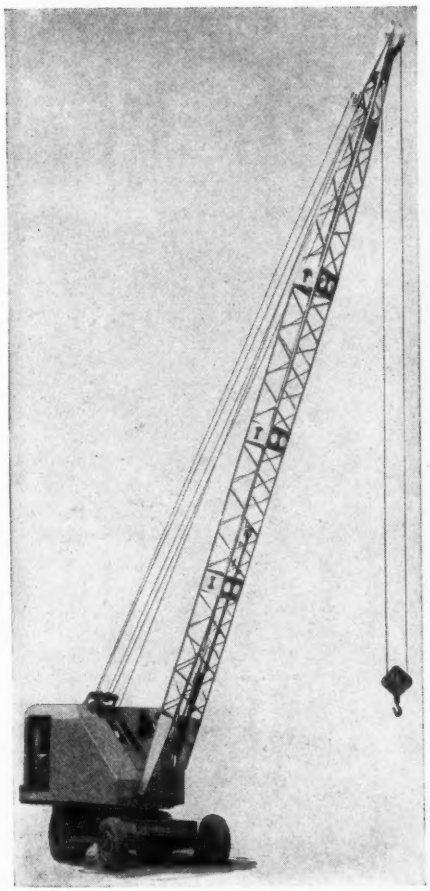

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Quiescent Clarification

International Filter Co.
325 W. 25th Place, Chicago, Ill.

This attractively printed booklet defines quiescent clarification as the condition existing when an ideal combination of the design factors which influence proper settling in a sludge removal mechanism is obtained. Such a condition is characteristic of Infilco Clarifiers.

Both small and large diameter clarifiers are described and a number of pictures showing actual installations are included. Mechanical drawings illustrate important details.

Of particular note are the new type of scum remover and the peripheral drive mechanism for larger clarifiers. The new Infilco Hydraulic Skimmer utilizes a flat circular plate to establish radial suction currents at the surface of the liquid. Scum is readily drawn toward a hole at the center of this plate where it is easily removed. The peripheral drive, for larger tanks, keeps distortion and vibration at a minimum and helps to maintain Quiescent Conditions. Write the company for Bulletin 2450.

New Booklet on Highway and Street Construction Equipment

The Galion Iron Works and Manufacturing Co., Galion, Ohio

"Our Part in National Defense" is the title. The text describes and illustrates Galion motor graders, tandem rollers, Galion chief rollers, portable rollers, trench rollers, Galion sheepsfoot rollers, and Galion spreaders. The purpose of the folder is to show how Galion equipment is playing a major role in the Defense Program in connection with building much needed highways, preparing the groundwork for airports, factories, cantonments, dams, and housing projects.

Reflecto-Products

The Star-Lite Marker Co., Indianapolis, Ind.

In a well-illustrated folder this company describes the Lane Marker—stainless steel, the Lane-Lite Marker—stainless steel, the Curb-Lite Marker, and a number of other types of traffic lane markers.

C. S. Johnson Co. Roadbuilders' Dutchmill Cement Plant

Roadbuilder's Dutchmill Cement Plants

The C. S. Johnson Company, Champaign, Ill.

This plant is designed and built to meet any situation arising in the use of bulk cement for highway building. It is efficient and economical for handling and batching bulk cement from hopper bottom cars, box cars or from trucks. Special features are: one man low operating cost; constructed in three or four complete sections for easy and fast set-ups and highway portability; may be used with any kind of cement transportation facilities, thus adaptable to most situations and practical to nearly any job; easily converted into cement transfer plant; no pit required for elevator.

Write for the 8-page bulletin which fully describes this new bulk cement plant and answers all questions.

Defense Regional Offices Reduced

The Federal Works Administration has reduced the number of Regional offices to seven, which are as follows:

Region 1—Director—James A. McConnell, 2 Lafayette Street, New York, N. Y., for States of Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, Pennsylvania and New Jersey; Region 2—Director—C. L. Vickers, Room 606, State Planters Bank Bldg., 904 East Main Street, Richmond, Va., for States of Delaware, Maryland, West Virginia, Virginia, North Carolina and the District of Columbia; Region 3—Director—Lester M. Marx, 22 Marietta Street Bldg., Atlanta, Ga., for States of South Carolina, Tennessee, Georgia, Alabama, Mississippi and Florida; Region 4—Director—George F. Harley, 801 Electric Building, Fort Worth, Texas, for States of Arkansas, Louisiana, Oklahoma and Texas; Region 5—Director—David R. Kennicott, Room 1901, 20 North Wacker Drive, Chicago, Ill., for States of Ohio, Kentucky, Michigan, Indiana, Illinois, Wisconsin, Minnesota, Iowa, Missouri, Kansas, Nebraska, South Dakota and North Dakota; Region 6—Director—Wright L. Felt, 1107 Continental Bldg., 408 South Spring St., Los Angeles, California, for States of Colorado, New Mexico, Utah, Arizona, Nevada and and California; Region 7—Director—L. R. Durkee, 511 Alaska Bldg., 618 Second Avenue, Seattle, Wash., for States of Washington, Oregon, Idaho, Montana, and Wyoming.

Readers' Service Department

These booklets are FREE. Use the coupon below or write the manufacturer direct, mentioning PUBLIC WORKS.

Construction Materials and Equipment

Asphaltic Limestone

5. Characteristics, methods of laying, and results with cold lay mixture shipped ready to use. Especially adapted to resurfacing old pavements, sealcoats and airport runways. Alabama Asphaltic Limestone Co., Liberty Nat. Life Bldg., Birmingham, Ala.

Bituminous Mixer

7. Exact control by volumetric proportioning. Continuous mixing and large capacity. The Barber-Greene mixer can be used as a unit of a travel plant or as a central plant. Excellent and instructive. Well illustrated book on request. Barber-Greene Co., Aurora, Ill.

Bridges

8. A new booklet, "Highway Structures of Douglas Fir," gives up-to-date designs and illustrations of various types of Guard Rails, Culverts, Trestles, Truss Bridges, Arch Bridges and Suspension Bridges built with Douglas Fir. This helpful booklet sent on request by the West Coast Lumbermen's Association, 364 Stuart Bldg., Seattle, Wash.

Cement Dispersion

9. "Economics of Cement Dispersion and Pozzolith" tells the complete story of how cement dispersion reduces water required up to 20% and increases workability 150%. Write The Master Builders Co., Cleveland, Ohio, for a copy.

Cold Mix Plants

10. New catalog and prices of Portable Bituminous Mixers in 6 to 14 ft. sizes for resurfacing and maintenance. Issued by The Jaeger Machine Co., 400 Dublin Ave., Columbus, Ohio.

Concrete Accelerators

29. "How Cotton Quilts are being used successfully for curing concrete" is a series of reprints from recent magazines available on request from Highway Materials Dept., National Automative Fibres, Inc., Little Falls, N. Y.

30. "How to Cure Concrete," a forty-seven page manual published by the Dow Chemical Company, Midland, Michigan, treats fully subject suggested by title.

31. New 48-page booklet in five sections explains clearly the effects, advantages and methods of using Calcium Chloride and Portland Cement mixes. Complete and packed with practical information; well illustrated; pocket size. Sent free on request by Solvay Sales Corp., 40 Rector St., New York, N. Y.

33. Pocket manual of concrete curing with calcium chloride. Complete, handy. Contains useful tables, well illustrated. Write the Columbia Chemical Division, Pittsburgh Plate Glass Co., 30 Rockefeller Plaza, N. Y. C.

Concrete Mixers

44. Catalog and prices of Concrete Mixers, both Tilting and Non-Tilt types, from 3½S to 56S sizes. The Jaeger Machine Company, 400 Dublin Ave., Columbus, Ohio.

Concreting in Winter

47. "Build Straight Through the Cold Weather Season" explains briefly how to obtain satisfactory winter concrete in less time. Write Michigan Alkali Co., 60 East 42nd St., New York, N. Y.

Drainage Products

70. Standard corrugated pipe, perforated pipe and MULTI PLATE pipe and arches — for culverts, sewers, subdrains, cattlepasses and other uses are described in a 48-page catalog entitled "ARMCO Drainage Products," issued by the Armco Drainage Products Association, Middletown, Ohio, and its associated member companies. Ask for Catalog No. 12.

71. Modern Culvert Practice — a 72 page book containing valuable data and tables will be sent promptly to anyone interested in drainage by Gohi Culvert Mfrs., Inc., Newport, Ky.

72. "3 Answers to Limited Headroom," a comparison of three ways of providing safe strength and adequate drainage under limited headroom. For copy ask Armco Drainage Products Assn., Middletown, Ohio.

73. "Principles of Design of Airport Drainage" and other articles on airport drainage reprinted from PUBLIC WORKS Magazine are being distributed free by Bowerston Shale Co., Bowerston, O., Hancock Brick & Tile Co., Findlay, O., and Columbus Clay Mfg. Co., Blacklick, O. Address anyone of the above for a copy.

Graders, Patrol

105. The Austin-Western 99M Power Grader with its powerful all wheel drive simplifies all construction and maintenance; handles difficult jobs with economy and efficiency; and does better work on grading, ditching, scarifying, snow plowing, loading, mixing, bulldozing, shoulder trenching and backsloping. Write for Bulletin 1946. Austin-Western Road Machinery Co., Aurora, Ill.

Mud-Jack Method

107. How the Mud Jack Method for raising concrete curb, gutter, walls and street solves problems of that kind quickly and economically without the usual cost of time-consuming reconstruction activities — a new bulletin by Koehring Company, 3026 West Concordia Ave., Milwaukee, Wis.

Paving Materials, Bituminous

111. An excellent booklet issued by The Barrett Co., 40 Rector St., New York, N. Y., describes and illustrates the uses of each grade of Tarvia and Tarvialithic; 32 good illustrations.

114. Columbia Paving Process for non-skid pavements include Plant Mixes by both the Heater and Cold Processes, Road Mix Process and Surface Treatment Process. New literature covering these processes is available from Colprovia Roads, Inc., 183 East Main St., Rochester, N. Y.

Paving Materials, Brick

116. "New Developments in Brick Pavements." A review of the developments in brick pavements in recent years. Issued by the National Paving Brick Association, National Press Building, Washingon, D. C.

Pumps

121. New illustrated catalog and prices of Jaeger Sure Prime Pumps, 2" to 10" sizes, 7000 to 220,000 G.P.H. capacities, also Jetting, Caisson, Road Pumps, recently issued by The Jaeger Machine Company, 400 Dublin Ave., Columbus, Ohio.

122. CMC pump bulletin illustrates and describes complete line of modern centrifugals made in sizes from 1½" to 10" by Construction Machinery Co., Waterloo, Iowa.

123. New brochure by Gorman-Rupp Co., Mansfield, Ohio, illustrates and describes many of the pumps in their complete line. Covers heavy duty and standard duty self-priming centrifugals, jetting pumps, well point pumps, triplex road pumps and the lightweight pumps.

124. 16-page illustrated bulletin, SP-37, describes and illustrates complete C. H. & E. line of self-priming centrifugal pumps from ½" to 8", including lightweight models for easy portability. C. H. & E. Mfg. Co., 3841 No. Palmer St., Milwaukee, Wis.

Retaining Walls

126. Charts showing the design of cellular or bin-type metal retaining walls, helpful suggestions on their use for stabilizing slopes, preventing stream encroachment, and solving problems of limited right of way, and construction details are given in a 16-page bulletin entitled, "ARMCO Bin-Type Retaining Walls." It is published by the Armco Drainage Products Association, Middletown, Ohio, and member companies. Ask for Bulletin H-37.

128. Motor Patrol Graders for road maintenance, road widening and road building, a complete line offering choice of weight, power, final drive and special equipment to exactly fit the job. Action pictures and full details are in catalogs Nos. 253, 254 & 255, issued by Gallon Iron Works & Mfg. Co., Gallon, Ohio.

129. New bulletins illustrate and describe the latest line of Littleford Utility Spray Tanks, Street Marking Units, Street Flushers and Kettles. Littleford Bros., 452 East Pearl St., Cincinnati, Ohio.

130. Toro patching rollers, tractors and mowers for parks, airports, estates, highways and golf courses are pictured and detailed in new illustrated booklet available from Toro Mfg. Co., Minneapolis, Minn.

Rollers

133. New Tu-Ton roller of simple construction for use in rolling sidewalks along highways, playgrounds and other types of light rolling is fully described in a bulletin issued by C. H. & E. Mfg. Co., 3841 No. Palmer St., Milwaukee, Wis.

138. "The Buffalo-Springfield line of road rollers (tandem, 3-wheel, and 3-axle) are described in the latest catalog issued by the Buffalo-Springfield Roller Co., Springfield, Ohio."

139. "Ironeroller" 3 Axle Roller for extra smooth surfaces on all bituminous work. Booklet contains roller data and operation details. Hercules Co., Marion, Ohio.

Skating Pond Sprays

141. How to make safe skating rinks on any vacant lots with the handy Masbruch spray is described in new literature issued by Russell Manufacturing Co., Dept. 2, Platteville, Wis.

Spreader

147. Jaeger Paving equipment, including Mix-in-Place Roadbuilders, Bituminous Pavers, Concrete Bituminous Finishers, Adjustable Spreaders, Forms, etc.—

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1-42

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Readers' Service Department

(Continued from page 55)

4 complete catalogs of latest equipment in one cover, issued by The Jaeger Machine Company, 400 Dublin Ave., Columbus, Ohio.

Soil Stabilization

150. "High-Service, Low Cost Roads" is one of the newer booklets using an effective combination of picture and text to set forth the principals and advantages of road surface stabilization with calcium chloride. Complete, interesting and well illustrated. 34 pages. Sent by Solvay Sales Corp., 40 Rector St., New York, N. Y.

152. The Columbia Alkali Corporation, will be glad to furnish to anyone interested complete information dealing with Calcium Chloride Stabilized Roads. This literature contains many charts, tables and useful information and can be obtained by writing Columbia Alkali Div., Pittsburgh Plate Glass Co., 30 Rockefeller Plaza, New York City.

154. "Soil Stabilization with Tarvia"—An illustrated booklet describing The steps in the stabilization of roadway soil with Tarvia will be mailed on request by The Barrett Company, 40 Rector St., New York, N. Y.

Tractors

159. "International Diesel TracTracTors" is a 48-page catalog giving full details of TracTracTors, including action pictures with bulldozers, bullgraders, blade graders, wheel scrapers, elevating graders, etc. Sent promptly by International Harvester Co., 180 North Michigan Ave., Chicago, Ill.

Street and Paving Maintenance

Asphalt Heaters

198. Illustrated Bulletins 15 to 20 describe Mohawk Oil Burning Torches; "Hotstuf" Tar and Asphalt Heaters; Portable Trailer Tool Boxes; Pouring Pots and other equipment for street and highway maintenance, roofing, pipe coating, water proofing, etc. Mohawk Asphalt Heater Co., Frankfort, N. Y.

Dust Control

210. "How to Maintain Roads with Dowflake" is a new 58 page illustrated booklet of information on stabilized road construction. Includes specifications and several pages of reference tables from an engineer's notebook. Issued by Dow Chemical Co., Midland, Mich.

211. A complete booklet on dust control titled, "Dust Control and Road Stabilization," describes the use of Columbia Calcium Chloride for dust control purposes and stabilization of roads. Sent on request by Columbia Alkali Div., Pittsburgh Plate Glass Co., 30 Rockefeller Plaza, New York, N. Y.

212. "Are You Annoyed by Dust?" an illustrated circular telling how to prevent dust with calcium chloride. Sent free by Michigan Alkali Co., 60 East 42 St., New York, N. Y.

Radio Communication, Two Way

250. Valuable information on how cities and towns all over the country have solved their radio communication problems is found in "Motorola Radio Communication Equipment." Write Galvin Mfg. Corp., 4545 West Augusta St., Chiccago, Ill.

Street Markers

300. Street marking simplified by the use of modern, self-contained units capable of handling any kind of striping jobs is the subject of an illustrated bulletin giving also full details of new M-B Street Markers. Sent by Meili-Blumberg Corp., Box PW, New Holstein, Wis.

Snow Fighting

Plows

350. "Frink One-Way Sno-Plows" is a four page catalog illustrating and describing 5 models of One-Way Blade Type Sno-Plows for motor trucks from 1½ up to 8 tons capacity. Interchangeable with V Sno-Plow. Features, specifications and method of attaching. Carl H. Frink, Mfr., Clayton, 1000 Islands, N. Y.

Ice Control

351. "Make Icy Highways Safe for Traffic"—a new bulletin by Michigan Alkali Co., 60 East 42 St., New York, N. Y., tells how to use calcium chloride for modern ice control.

Sanitary Engineering

Activated Alum

354. "Technical Data on Activated Alum and Dustless Blackalum" points out the analytical side of Activated Alum and Blackalum. Write Activated Alum Corp., 516 No. Charles St., Baltimore, Md.

Aero-Filter

356. "Results Produced by Aero-Filters" is a new pamphlet covering results at Temple, Texas; Paris, Ill.; Webster City, Iowa; and Mason, Mich. Write Lakeside Engineering Corp., 222 West Adams St., Chicago, Ill.

Air Release Valves

357. Automatic Air Release Valves for water, sewage and industrial uses are described and illustrated in new catalog issued by Simplex Valve & Meter Co., 6750 Upland St., Philadelphia, Pa.

Analysis of Water

360. "Methods of Analyzing Water for Municipal and Industrial Use" is an excellent 94 page booklet with many useful tables and formulas. Sent on request by Solvay Sales Corp., 40 Rector St., New York, N. Y.

Activation and Aeration

376. A valuable booklet on porous diffuser plates and tubes for sewage treatment plants. Covers permeability, porosity, pore size and pressure loss data, with curves. Also information on installations, with sketches and pictures, specifications, methods of cleaning and studies in permeability. 20pp. illustrated. Sent on request to Norton Company, Worcester, Mass.

Cleaning Sewers

383. A 20-page booklet describes and illustrates a full line of sewer cleaning equipment—Rods, Root Cutters, Buckets, Nozzles and Flushers. Write W. H. Stewart (Pioneer Mfr. since 1901), Jacksonville, Fla., or P. O. Box 767, Syracuse, N. Y.

384. A new 32-page, illustrated booklet explains how a city can clean its sewers and culverts with its own forces using the up-to-date Flexible Sewer Rod equipment. Illustrates and describes all necessary equipment. Issued by Flexible Sewer Rod Equipment Co., 9059 Venice Boul., Los Angeles, Calif.

Feeders, Chlorine, Amonia and Chemical

387. For chlorinating water supplies, sewage plants, swimming pools and feeding practically any chemical used in sanitation treatment of water and sewage. Flow of water controls dosage of chemical; reagent feed is immediately adjustable. Starts and stops automatically. Literature from % Proportioneers, Inc. % 96 Codding St., Providence, R. I.

Filter Bed Agitator

388. 60-page booklet, "The Mechanics of Filter Bed Agitation," containing engineering data, technical information concerning surface wash and opinions of users will be sent promptly by Stuart-Brumley Corp., 516 No. Charles St., Baltimore, Md.

Filter Plant Controllers

389. "The Modern Filter Plant" and the uses of Simplex Controllers for operation are described in a handy, 16-page booklet. Charts, data, curves and tables. Simplex Valve and Meter Co., 6750 Upland St., Philadelphia, Pa.

Fire Hydrants

390. Specifications for standard AWWA fire hydrants with helpful instructions for ordering, installing, repairing, lengthening and using. Issued by M. & H. Valve & Fittings Co., Anniston, Ala.

391. See listing No. 410.

Flow Meters

393. The primary devices for flow measurement—the orifice, the pilot tube, the venturi meter and others — and the application to them of the Simplex meter are described in a useful 24-page booklet (42A). Simplex Valve and Meter Co., 6750 Upland St., Philadelphia, Pa.

Gates, Valves, Hydrants

394. Gate, flap and check valves; floor stands and fittings. New catalog No. 34 gives detail information with dimensions for all types of new full line. M. & H. Valve & Fittings Co., Anniston, Ala.

395. Complete booklet with much worthwhile water works data describes fully Ludlow hydrants and valves. Sent on request. Ludlow Valve Mfg. Co., Troy, N. Y.

396. See listing No. 410.

Gauges

398. The full line of Simplex gauges for filtration plants are illustrated and described in catalog issued by Simplex Valve and Meter Co., 6750 Upland St., Philadelphia, Pa.

Hypochlorinators

400. New illustrated booklet W&T 357 describes this simple, inexpensive means of protecting small water supplies such as summer camps, hotels, swimming pools, dairies, etc., as well as for feeding chemical solutions in the water works plant. Contains typical installation sketches. Write "Wallace & Tiernan Co., Inc., Newark, N. J.

Manhole Covers and Inlets

402. Street, sewer and water castings in various styles, sizes and weights. Manhole covers, water meter covers, adjustable curb inlets, gutter crossing plates, valve and lamphole covers, ventilators, etc. Described in catalog issued by South Bend Foundry Co., Lafayette Boul. and Indiana Ave., South Bend, Ind.

Manhole Cover Silencers

403. New bulletin on Tapax for quickly ending noisy manhole covers and small sample free. Write Tapax Mfg. Co., 201 Hoyt Ave., Mamaroneck, N. Y.

Meters, Venturi

405. MS Meters for use with venturi tubes, flow nozzles, etc., in wall, panel, or floor mounting are covered in detail in catalog sent free by Simplex Valve & Meter Co., 6750 Upland St., Philadelphia, Pa.

406. New bulletin illustrates Builders Air Relay system of transmission for the Venturi Meter which is particularly useful for liquids containing suspended solids like sewage. Eliminates corroson, clogged pipes, etc. Write Builders Iron Foundry, Codding St., Providence, R. I.

Pipe, Cast Iron

408. Handbook of Universal Cast Iron Pipe and Fittings, pocket size, 104 pages, illustrated, including 14 pages of useful reference tables and data. Sent by The Central Foundry Co., 386 Fourth Ave., New York, N. Y.

409. Cast iron pipe and fittings for water, gas, sewer and industrial service.

Super-deLavaud centrifugally-cast and pit-cast pipe. Bell-and-spigot, U. S. Joint, flanged or flexible joints can be furnished to suit requirements. Write U. S. Pipe and Foundry Co., Burlington, N. J.

410. "Cast Iron Pipe and Fittings" is a well illustrated 44 page catalog giving full specifications for their complete line of Sand Spun Centrifugal Pipe, Fire Hydrants, Gate Valves, Special Castings, etc. Will be sent promptly by R. D. Wood Co., 400 Chestnut St., Philadelphia, Pa.

Pipe Forms

411. Making concrete pipe on the job to give employment at home is the subject of a new booklet just issued by Quinn Wire and Iron Works, 1621 Twelfth St., Boone, Ia., manufacturers of "Heavy Duty" Pipe Forms. Sent promptly on request.

Pipe, Reinforced Concrete

412. Literature describing the manufacture and installaton of Lock Joint Reinforced Concrete Pressure Pipe for water supply lines and sewer force mains. Lock Joint Pipe Co., Ampere, N. J.

Pipe Repair Materials

413. Repair clamps and saddles for steel and cast iron pipe; pipe line clamps; pipe joint clamps and many other handy and economical tools for the water works man. Catalog 41. M. B. Skinner Company, South Bend, Ind.

Pipe, Transite

414. Two new illustrated booklets, "Tansite Pressure Pipe" and "Transite Sewer Pipe" deal with methods of cutting costs of installation and maintenance of pipe lines and summarize advantages resulting from use of Transite pipes. Sent promptly by Johns-Manville Corp., 22 East 40th St., New York, N. Y.

Pipe Joints, Sewer

415. How to make a perfect sewer pipe joint—tight, prevents roots entering sewer, keeps lengths perfectly aligned; can be laid with water in trench or pipe. General instructions issued by L. A. Weston, Adams, Mass.

Pipe, 2-inch Cast Iron

417. Generously illustrated booklet describes McWane 2-inch cast iron pipe and its manufacture in streamlined pipe shop. Write McWane Cast Iron Pipe Co., Birmingham, Ala.

Pumps and Well Water Systems

420. Installation views and sectional scenes on Layne Vertical Centrifugal and Vertical Turbine Pumps fully illustrated and including useful engineering data section. Layne Shutter Screens for Gravel Wall Wells. Write for descriptive booklets. Advertising Dept., Layne & Bowler, Inc., Box 186, Hollywood Station, Memphis, Tenn.

Meter Setting and Testing

430. The most complete catalog we have seen on setting and testing equipment for water meters—exquisitely printed and illustrated 48-page booklet you should have a copy of. Ask Ford Meter Box Co., Wabash, Ind.

Recarbonation

431. Bulletin describes stabilizing lime-softened water by recarbonation, discussing gas production, washing, compressing, drying, and applying the CO(2). International Filter Co., 325 West 25th Place, Chicago, Ill.

Sand Expansion Indicator

432. New bulletin gives full details of Simplex Sand Expansion Indicators for water plants. Write Simplex Valve & Meter Co., 6750 Upland St., Philadelphia, Pa.

434. Be assured of uninterrupted, constant automatic removal of screenings. Folder 1587 tells how. Gives some of the outstanding advantages of "Straightline Bar Screens" (Vertical and Inclined types). Link-Belt Co., 307 N. Michigan Ave., Chicago, Ill.

Steel Sheet Piling

436. "Metal Sheeting for Lower Average Job Costs" is a new bulletin about light weight sheeting you can use again and again. Issued by Armco Drainage Products Assn., Middletown, Ohio.

Sewers

437. "ARMCO Sewers" is the title of a 48-page booklet describing the structural and other advantages of ARMCO Ingot Iron. Paved Invert and Asbestos-Bonded pipe for storm and sanitary sewers. Design data and large charts will be found helpful by engineers engaged in the design or construction of sewers. Copies will be sent on request by the Armco Drainage Products Association, Middletown, Ohio, or its associated member companies.

Septic Tanks, Small

438. Septic Disposal Systems, Waterless Toilets, Multiple Toilets for Camps and Resorts, and other products for providing safer sewage disposal for unsewered areas are described and illustrated in data sheets issued by San-Equip Inc., 504 E. Glen St., Syracuse, N. Y.

Sludge Drying and Incineration

440. "Disposal of Municipal Refuse." Complete specifications and description including suggested form of proposal; form of guarantees; statements and approval sheet for comparing bids with diagramatic outline of various plant designs. 48 pages. Address: Morse Boulger Destructor Co., 216-P East 45th St., New York, N. Y.

441. Full information about Nichols modern, efficient gabage and refuse incinerators now available in the Basket Grate, Continuous Grate, Revolving Grate and Monohearth types will be sent promptly by Nichols Engineering and Research Corp., 60 Wall Tower, New York, N. Y.

442. Recuperator tubes made from Silicon Carbide and "Fireclay" Corebusters for maximum efficiency are described and illustrated in bulletin No. 11 issued by Fitch Recuperator Co., Plainfield National Bank Bldg., Plainfield, N. J.

443. Nichols Herreshoff incinerator for complete disposal of sewage solids and industrial wastes — a new booklet illustrates and explains how this Nichols incinerator works. Pictures recent installations. Write Nichols Engineering and Research Corp., 60 Wall Tower, New York, N. Y.

Swimming Pools

446. Data and complete information on swimming pool filters and recirculation plants; also on water filters and filtration equipment. For data prices, plans, etc., write Roberts Filter Mfg. Co., 640 Columbia Ave., Darby, Pa.

447. 40-page Manual on swimming pools. Includes swimming and pool layouts, specifications, etc., and details concerning Permutit Swimming Pool Equipment. Write The Permutit Co., Dept. G-4, 330 West 42 St., New York, N. Y.

Taste and Odor Control

450. Technical pub. No. 207 issued by Wallace & Tiernan Co., Inc., Newark, N. J., describes in detail taste and odor control of water with BREAK-POINT Chlorination, a method of discovering the point at which many causes of taste may be removed by chlorination with little or no increase in residual chlorine. Sent free to any operator requesting it.

452. "Water and Sewage Chemistry" is the title of a valuable booklet for the operating man, reprinted from PUBLIC WORKS Magazine for December, 1940, by General Chemical Co., 40 Rector St., New York, N. Y.

Treatment

453. "Safe Sanitation for a Nation," an interesting booklet containing thumbnail descriptions of the different pieces of P.F.T. equipment for sewage treatment. Includes photos of various installations and complete list of literature available from this company. Write Pacific Flush Tank Co., 4241 Ravenswood Ave., Chicago, Ill.

455. New booklet (No. 1642 on Link-Belt Circuline Collectors for Settling Tanks contains excellent pictures; drawings of installations, sanitary engineering data and design details. Link-Belt Company, 2045 W. Hunting Park Ave., Philadelphia.

456. New 16-page illustrated catalog No. 1742 on Straightline Collectors for the efficient, continuous removal of sludge from rectangular tanks at sewarage and water plants. Contains layout drawings, installation pictures, and capacity tables. Address Link-Belt Co., 2045 West Hunting Park Ave., Philadelphia, Pa.

457. New illustrated folder (1942) on Straightline apparatus for the removal and washing of grit and detritus from rectangular grit chambers. Address: Link-Belt Co., 2045 W. Hunting Park Ave., Philadelphia, Pa.

458. "Sedimentation with Dorr Clarifiers" is a complete 36-page illustrated catalog with useful design data. Ask The Dorr Company, 570 Lexington Ave., New York, N. Y.

459. A combination mechanical clarifier and mechanical digester, The Dorr Clarigester, is explained and illustrated in a bulletin issued by The Dorr Company, 570 Lexington Ave., New York, N. Y.

460. This new 145 page illustrated chemical products book contains 55 pages of Tables, Factors and valuable Reference Data. Issued by General Chemical Co., 40 Rector St., New York, N. Y.

461. Preflocculation without chemicals with the Dorrco Clariflocculator in a single structure is the subject of a new booklet issued by The Dorr Company, 570 Lexington Ave., New York, N. Y.

462. Dorrco Monorake for existing rectangular sedimentation tanks, open or closed, is described and illustrated in a new catalog sent on request. The Dorr Co., 570 Lexington Ave., New York, N. Y.

Tunnel Liners

480. "Save Money with Armco *Light Duty* Tunnel Liner" is a bulletin you'll want if you are interested in economical, long lasting tunnels. Write Armco Drainage Products Assn., Middletown, Ohio.

Valves (See Gates, Air Release, etc.)

Water Works Operating Practices

490. "Important Factors in Coagulation" is an excellent review with bibliography and outlines of latest work done in the field. Written by Burton W. Graham and sent free on request to Activated Alum Corp., 516 No. Charles St., Baltimore, Md.

491. "Soft Water for Your Community" tells by means of many interesting pictures and text the advantages of soft water to any community. Ask for a copy from The Permutit Co., Dept. G4, 330 West 42nd St., New York, N. Y.

492. "Alkalies and Chlorine in the Treatment of Municipal and Industrial Water" is a new comprehensive survey filled with tables, charts, cost comparisons, etc., valuable to all who treat large volumes of water. Write Solvay Sales Corp., 40 Rector Street, New York City.

Water Service Devices

500. Data on anti-freeze outdoor drinking fountains, hydrants, street washers, etc., will be sent promptly on request to Murdock Mfg. & Supply Co., 426 Plum St., Cincinnati, Ohio.

For the Engineer's Library

Brief reviews of the latest books, booklets and catalogs for the public works engineer.

War Emergency Water Works Catalog

M. B. Skinner Co., South Bend, Ind.

This timely catalog describes, illustrates and explains how to attach Skinner--Seal Bell and Spigot Joint for Stoping Leaks under Pressure; Skinner-Seal Split Coupling Clamp for repairing broken Cast Iron mains; Emergency Pipe Clamps for repairing pit holes, splits and corrosion leaks; Pipe Line Clamps for long splits or very bad corrosion; Pipe Joint Clamps for stopping leaks at joints where pipe is screwed into fittings; Collar Leak Clamp for stopping all types of collar leaks; High Pressure Weld Clamp for stopping leaks in welded joints; Vented Plug Clamps for stopping extremely high-pressure pipe lines; Service Saddle for making water and gas service connections.

For nearly 50 years this company's repair clamps and service fittings have been in use the world over. Write for catalog No. 41.

New Appointments

The following appointments were recently reported:

City Engineers:
Mike Egan, Walsenburg, Colo.
Rodney Baxter, Quincy, Ill.
Neal F. Harr, McPherson, Kan.
C. R. Hisler, Benton Harbor, Mich.
Ralph L. Signor, Plattsburg, N. Y.
E. S. McLean, Mt. Airy, N. C.
J. A. Petche, Cleveland, Ohio.
John Hale, Dayton, Ohio.
George Long, Delaware, Ohio.
I. G. Hershey, Columbia, Pa.
Hobart Greene, Johnson City, Tenn.
Louis Domingues, Kerrville, Tex.

City Managers:
J. W. Marlidge, Newport, Ky.
H. L. Wagner, Kingsford, Mich.
Fred Quinell, Act., Bozeman, Mont.
Richard Beihl, Portsmouth, Ohio.
A. E. Munday, Brownsville, Tex.

County Engineers:
G. H. McMillan, Cobb Co., Marietta, Ga.
T. M. Harvey, Edgar Co., Paris, Ill.
E. E. Bruce, Marion Co., Act., Salem, Ill.
John Sullivan, Haskell Co., Sublette, Kan.
Henry Williams, Morgan Co., Versailles, Mo.
M. F. Deets, Adams Co., Hastings, Nebr.
J. C. Harding, Westchester Co., White Plains, N. Y.
Henry McCrady, Pickaway Co., Circleville, Ohio.

Water Works Superintendents:
Fred Schad, Pensacola, Fla.
Carl Duy, Aurora, Ill.
Ray Grover, Elko, Nev.
John Murray, Johnson City, Tenn.

Index to ADVERTISEMENTS

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